FORD **Transit & E-Transit**
Body and Equipment Mounting Manual
North America

POWER ELECTRIC
COMPANY

Date of Publication: 04/2024

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☐ Abc = BEV Only ☐ Abc = ICE Only

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1.1 About this Publication

This **Body and Equipment Mounting Manual (BEMM)** is the publication for the 2024 MY Job 2 Transit & E-Transit.

The main changes in this version are:

April 2024

Extended Range Battery content added to the following sections:
1.7.2 E-Transit BEV Vehicles
3.7.2 High Voltage System Overview
3.7.4 HV Cooling System
4.2.12 Precautionary Drill Zones - HV Cables
4.2.13 Precautionary Drill Zones - HV Modules LV Cables and Connectors
4.2.14 Precautionary Drill Zones - Cable Grounding
4.2.15 Precautionary Drill Zones - Chassis Grounding
5.1.1 Body Structures - General Info
5.1.5 No Drill/No Weld Zones - BEV
5.1.6 BEV Van Floor Drilling

Additional updates
1.3.2 General Product Safety Requirement: Warning added
1.5 Electromagnetic Compatibility (EMC): Warning amended
1.9 Vehicle Transportation Aids and Vehicle Storage: Warning added and text updated
1.10.6 Vehicle Dimensions: Date amended
1.10.7 Chassis Cab Body Extensions: Header amended
3.2.2 Fuel Fired Auxillary Heaters: Header amended
3.4 Automatic Transmission, Transfer Case: Reference to tachograph removed
3.5 Exhaust System: Caution added
3.5.3 Exhaust Heat Shields: Caution added
4.1.1 Electrical Architecture Changes: Section removed
4.3.1 CAN-Bus System Description and Interface: Electrical architecture updated
4.4.2 System Layouts (Alternator-Based & BEV): BEV image updated
4.5.1 Power and Connectivity Usage Recommendations: Updated
4.5.3 Guidelines When Converting Vehicles: Updated
4.5.6 Battery Configurations : Updated
4.5.9 Single and Twin Battery Systems: Updated
4.6.3 Power Connections: **Updated**
4.7 Climate Control System : Updated to remove FWD reference
4.10.1 Start-Stop: Section removed
4.15 Adaptive Cruise Control: Header and image updated
4.5.16/17 Ford Programmable Battery Guard : Sections removed
4.24.6 High Specification Vehicle Interface Connector: Section removed
5.5 Internal Partitions/Bulkhead: Section added
5.8 Door Mirrors: Header updated
5.12.2 Roof Racks and Load Carriers: Note deleted; Load not to exceed 190kg total for roof structure durability.

Please refer to the relevant sections for further information.

It is recommended to review this manual in full. The **BEMM** is a live document which can be viewed on https://fordbbas.com. It is the Vehicle Modifier's responsibility to review the online version for the most current information prior to starting any modification.

For further information please go to the **Body Builders Advisory Service**, https://fordbbas.com, or email bbasqa@ford.com

1.1.1 EV Training

Ford Customer Service Division (FCSD) develops the training and deploys it to the Ford Dealer Network. We will forward and/or provide our upfitter partners the information to obtain training through links in Body Builder Layout Books and through www.motorcraftservice.com

Recommended training regarding vehicle High Voltage systems: https://www.motorcraftservice.com/Product/Training

Select "**High Voltage Systems**", then select "**High Voltage Systems Safety**" course **F414101103** (fee applies). Other courses that are applicable to your interest and needs may also be offered at this site.

Emergency Response Guide will be found at this link: https://www.fleet.ford.com/showroom/resources/

Ford Tool Resources via https://rotunda.service-solutions.com

1.1.2 Colour Coded Content

A colour coding system is in place to identify different content:

☐ Abc = ICE Only

Blue boxes behind text and illustrations bordered in blue indicate content specific to Transit Internal Combustion Engine (ICE) vehicles only.

☐ Abc = BEV Only

Green boxes behind text and illustrations bordered in green indicate content specific to E-Transit Battery Electric Vehicle (BEV) only.

☐ Abc = Common to ICE/BEV

Black text and illustrations bordered in black are common to ICE (Gasoline) engined versions and E-Transit Battery Electric Vehicle (BEV).

1.2 About this Manual

1.2.1 Introduction

This manual has been written in a format that is designed to meet the needs of Vehicle Modifiers. The objective is to use common formats with the workshop manual which is used by technicians worldwide.

This guide is published by Ford and provides general descriptions and advice for modifying vehicles.

It must be emphasized that any change to the basic vehicle, which does not meet the enclosed guideline standards, may severely inhibit the ability of the vehicle to perform its function. Mechanical failures, structural failure, component unreliability or vehicle instability will lead to customer dissatisfaction. Appropriate design and application of body, equipment and or accessories is key to ensuring that customer satisfaction is not adversely affected.

The information contained within this publication takes the form of recommendations to be followed when vehicle modifications are undertaken. It must be remembered that certain modifications may invalidate legal approvals and application for re-certification may be necessary.

Ford cannot guarantee the operation of the vehicle if non-Ford approved electrical systems are installed. Ford electrical systems are designed and tested to function under operational extremes and have been subjected to the equivalent of ten years of driving under such conditions.

This manual may contain references to features and options that have not been fitted to your particular vehicle. Variations occur across territories and can also be affected by external factors. For availability of features and options, please contact your local Ford dealer. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com, or please contact bbasqa@ford.com

1.2.2 How to Use This Manual

This manual covers vehicle modification procedures.

The pages at the start of this manual list the content, by group. A group covers a specific portion of the vehicle. The manual is divided into five groups:

- General Information
- Chassis
- Powertrain
- Electrical
- Body and Paint

The number of the group is the first number of a section number. Each title listed in the contents, links to the relevant section of the manual.

In some sections of the manual it may refer you to see additional sections for information. The links have been provided in blue text. Page numbers have also been provided for printed manuals. There is also an alphabetical index at the back of the manual. As with the contents pages, you will be able to link to sections. To do this just click on the page number.

All left and right handed references to the vehicle are taken from a position sitting in the driver's seat, looking forward, unless otherwise stated.

1.2.3 Important Safety Instructions

Appropriate modification procedures are essential for the safe, reliable operation of all vehicles as well as the personal safety of the individual carrying out the work.

This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Anyone who does not follow the instructions provided in this manual must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or components.

As you read through this manual, you will come across: WARNINGS, CAUTIONS and NOTES.

If a warning, caution or note is placed at the beginning of a series of steps, it applies to multiple steps. If the warning, caution or note only applies to one step, it is placed at the beginning of the specific step (after the step number).

WARNING: Warnings are used to indicate that failure to follow a procedure correctly may result in death or personal injury.

CAUTION: Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.

NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory modification.

WARNING: Any personnel working with or undertaking any modifications to the E-Transit BatteryElectric Vehicle (BEV) must receive training for High Voltage (HV) vehicle systems prior to starting any work.

Working on a High Voltage Electrical Vehicles is only allowed after completion of the appropriate training(s):

"Working on Electrical Vehicles" includes performing mechanical works, performing electrical work and switching activities on these vehicles.

"Electrical Vehicle" includes all possible types such as HEV (Full Hybrids), PHEV (Plug-In Hybrid Electric Vehicle), BEV (Battery Electric Vehicle) or other versions.

“Appropriate Training” means that you as a person who followed the training, has sufficient knowledge about the risks and that you have knowledge about the required safety measures to perform the work in a safe way. The competencies granted by this training are still up-to-date and have not expired.

⚠ **WARNING: Orange coloured cables are HV system (approximately 450V DC) parts and must not be modified nor rerouted.**

CAUTION: There are limitations when adding additional electrical devices. Any power take-off consumption needs to be controlled within the guidelines. Extra equipment and usage may have an impact to weight and vehicle driving range.

1.2.4 Supplemental Information

For further information please go to the Body Builders Advisory Service, https:// fordbbas.com/, or email bbasqa@ford.com

1.3 Commercial and Legal Aspects

1.3.1 Legal Obligations and Liabilities

The Vehicle Modifier should consult with their legal advisor on any questions concerning their legal obligations and liabilities.

1.3.2 General Product Safety Requirement

The Vehicle Modifier shall ensure that any vehicle it places on the market complies with all F/CMVSS standards.

The Vehicle Modifier shall release Ford from all liability for damages resulting from:

- Failure to comply with these Body Equipment Mounting Manual directives - in particular, Warnings
- Faulty design, production, installation, assembly or alteration not originally specified by Ford
- Failure to comply with the basic fit for purpose principles inherent in the original product

WARNINGS:

Do not exceed the Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), Gross Axle Weight Rating (GAWR), Front Gross Axle Weight Rating (FGAWR), Rear Gross Axle Weight Rating (RGAWR) or trailer ratings.

Do not change the tire size or load rating.

Do not modify the steering system.

Excessive heat can build up from the exhaust system, in particular from the catalytic converter. Ensure adequate heat shields are maintained. Maintain sufficient clearance to hot parts.

The travel and function of pedals must not be restricted.

Do not modify or remove heat protection shields.

Do not route any electrical cables with the Anti-lock Braking System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang electrical cables off existing harnesses or pipes.

Do not change original location or remove warning labels provided with the base vehicle in view to the driver. Ensure that labels remain in full view.

NOTE: For further information please go to the Body Builders Advisory Service, https://fordbbas.com, or email bbasqa@ford.com

Refer to: 1.4 Contact Information

1.3.3 Restraints System

WARNINGS:

Modifications to the restraints system are not allowed.

Airbags are explosive. For safe removal and storage during modification follow the procedures in the Ford workshop manual.

Do not alter, modify or relocate the airbag, sensor and modules of the restraints system or any of its components.

Attachments or modifications to the front end or B Pillar of the vehicle may affect the airbag deployment timing and result in uncontrolled deployment.

For additional information:
Refer to: 5.11 Airbag Supplemental Restraint System (SRS)

1.3.4 Drilling and Welding

WARNING: Do not Drill or Weld Boron steel parts, see figures E184299 and E185270 in the welding section of this manual.

Refer to: 5.1 Body

Drilling and welding of frames and body structure have to be conducted following the guidelines in Welding and Frame Drilling and Tube Reinforcing sections.

Refer to: 5.15 Frame and Body Mounting

1.3.5 Minimum Requirements for Brake System

It is not recommended to modify the brake system. If a special modification should require modifications:

- Maintain original settings
- Maintain brake certification load distribution

Changes to the Anti-lock Brake System (ABS), Traction Control System (TCS) and Electronic Stability Control ESC (also known as ESP) system are not permitted.

1.3.6 Road Safety

The respective instructions should be strictly observed to maintain operational and road safety of the vehicle.

1.3.7 Acoustic Vehicle Alerting System

WARNING: Do not move or modify the components of the AVAS system. The Acoustic Vehicle Alerting System warning is a legal requirement.

Refer to: 4.17 Acoustic Vehicle Alerting System

1.4 Contact Information

As a manufacturer, we want to provide you with the information you need for your vehicle modification. If the information you require is not in this manual or you have further questions, please contact Ford Body Builders Advisory Service at https://fordbbas.com, telephone 877-8404338 or email bbasqa@ford.com

1.5 Electromagnetic Compatibility (EMC)

WARNINGS:

Radio Frequency (RF) transmitter equipment (for example: cellular telephones, amateur radio transmitters) may only be fitted to your vehicle if they comply with the parameters shown in the 'Frequency Overview' table and the antennas may only be fitted to positions identified in figure E193241. It is the vehicle modifier's responsibility to make sure that any equipment fitted complies with applicable local legislation. Make sure any equipment is fitted by an authorized dealer.

Do not mount any transceiver, microphones, speakers, or any other item on or near the airbag cover, on the side of the seatbacks (of the front seats), or in front seat areas that may come into contact with a deploying airbag.

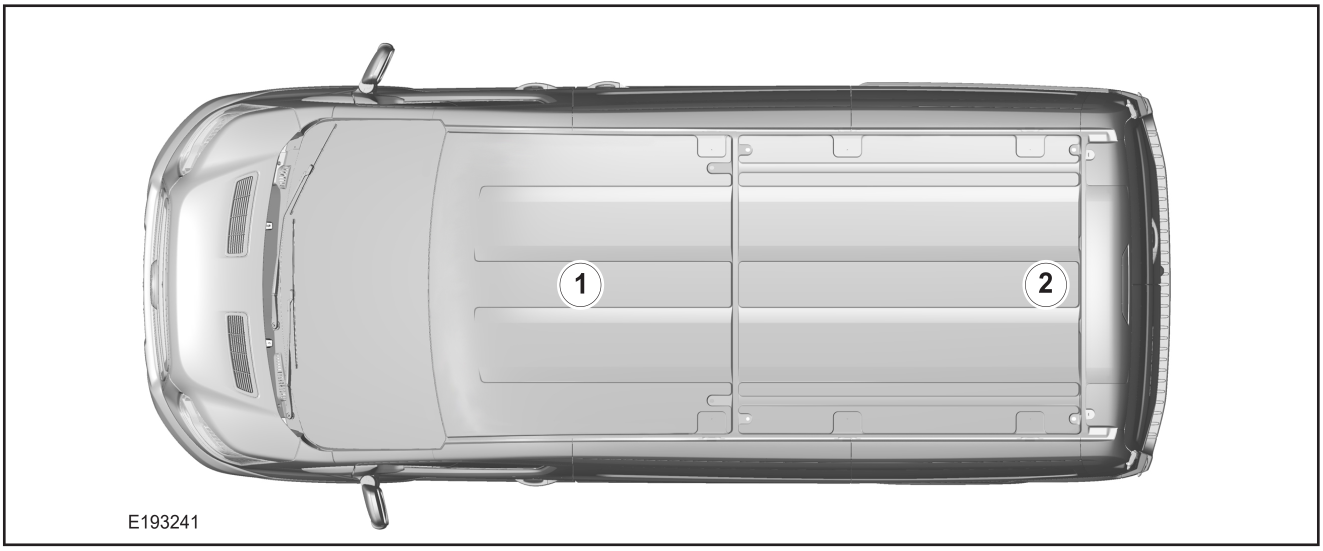
Do not fasten antenna cables to original vehicle wiring, fuel pipes and brake pipes.

Keep antenna and power cables at least 3.9" (100mm) from any electronic modules and airbags.

Frequency Overview

Frequency Band MHz	Maximum Output Power Watts (Peak RMS)	Antenna Position
1 - 30	50W	2
30 - 54	50W	1, 2
68 - 87.5	50W	1, 2
142 - 176	50W	1, 2
380 - 512	50W	1, 2
806 - 940	10W	1, 2
1200 - 1400	10W	1, 2
1710 - 1885	10W	1, 2
1885 - 2025	10W	1, 2

1.5.1 Permitted Antenna Locations



Item	Description
1	Antenna Location 1
2	Antenna Location 2

NOTE: Only fit the antenna to the roof of your vehicle in the positions shown

NOTE: After the installation of RF transmitters, check for disturbances from and to all electrical equipment in the vehicle, both in the standby and transmit modes.

Check all electrical equipment:

- With ignition **ON**
- With the engine running/vehicle ready to drive
- During a road test at various speeds

Check that electromagnetic fields generated inside the vehicle cabin, by the transmitter installed, do not exceed applicable human exposure requirements.

1.6 Vehicle Duty Cycle Guidelines

NOTE: For further information please go to the Body Builders Advisory Service, https://fordbbas.com, or email bbasqa@ford.com

It is necessary to take into account the customer usage profile and the anticipated vehicle duty cycles of the modified vehicle in order to choose the appropriate specification of the base vehicle.

It is necessary to select the appropriate drive, engine, gear ratio, Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), Gross Axle Weight Rating (GAWR), Front Gross Axle Weight Rating (FGAWR), Rear Gross Axle Weight Rating (RGAWR) and payload of the base vehicle to match the customer requirements.

Where possible, make sure that the base vehicle is ordered with any necessary plant fit options.

A high numeric gear ratio is recommended for vehicles with customer requirements for:

- High payload
- Trailer tow
- Frequent stop-go cycles
- High altitude and gradients
- Terrain conditions such as found on building and construction sites

1.6.1 Modification Impact on Fuel Economy and Performance

Any modification may affect the fuel consumption and performance depending on the aerodynamics and the weight added by the modification. It is advisable to control the weight, but without deteriorating other vehicle attributes and functions (especially those related to safety and durability).

1.6.2 Vehicle Ride and Handling Attributes

CAUTION: Do not exceed the Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), Gross Axle Weight Rating (GAWR), Front Gross Axle Weight Rating (FGAWR), Rear Gross Axle Weight Rating (RGAWR) or trailer rating limits.

NOTE: Raising the center of gravity will affect ride and handling.

NOTE: The vehicle should be evaluated for safe operation prior to sale.

1.7 Lifting

⚠ **WARNING: When lifting the vehicle with a two post lift, for the removal of the engine/transmission or rear axle, make sure the vehicle is secured to the lift using vehicle retention straps to prevent tilting. Failure to follow these instructions may result in personal injury.**

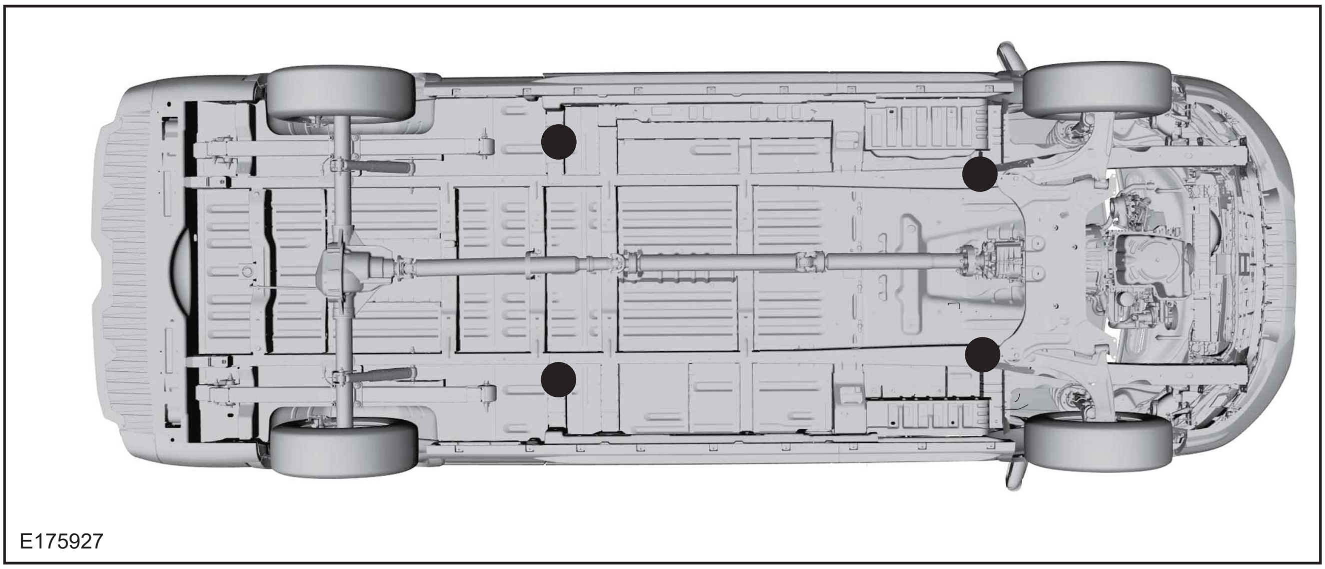
CAUTIONS:

- **When lifting the vehicle with two post lift, vehicle lift arm adapters must be used under the lifting points.**
- **When lifting the vehicle with a two post lift, the maximum curb weight must not be exceeded.**
- **It is important that only the correct lifting and support locations are used at all times.**
- **Ensure there is sufficient clearance when positioning the lifting equipment to prevent damage of any underfloor components.**

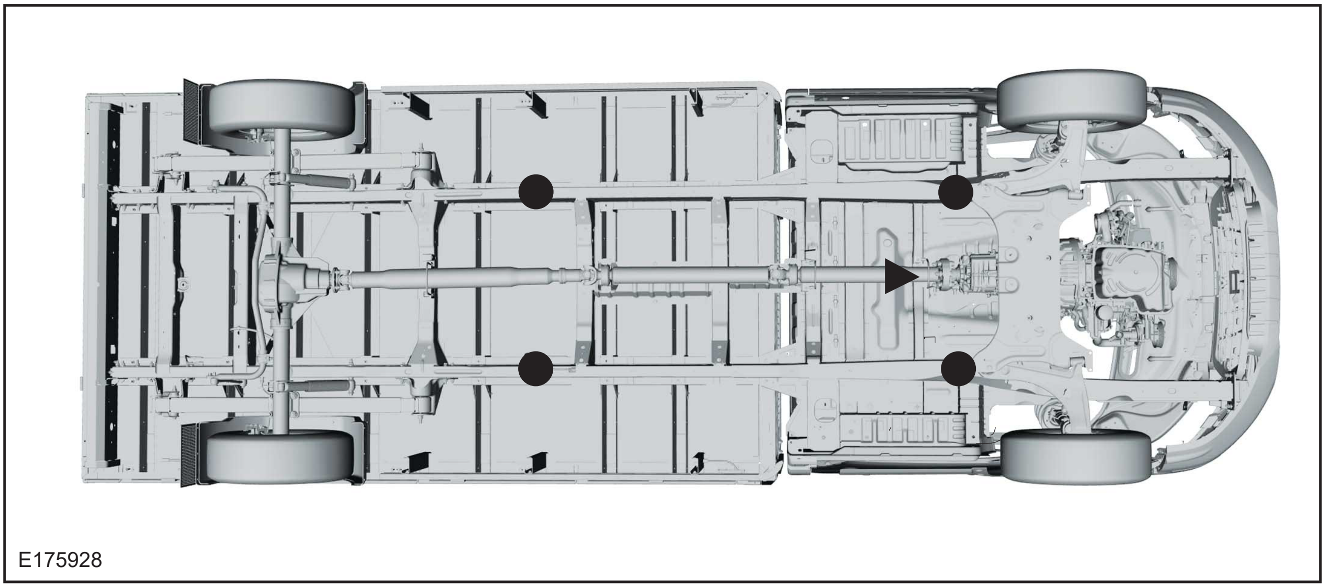
NOTE: For further information refer to the Owner's Manual.

1.7.1 ICE (Gasoline) Vehicles

Lifting Points - Van, Wagon


E175927

Lifting Points - Chassis Cab/Cutaway


E175928

1.7.2 E-Transit BEV Vehicles

WARNING: The E-Transit BEV must NOT be lifted using the Battery, Battery Cradle, Side Impact Protection. Megabrace or Electric Drive Assembly as a lifting point

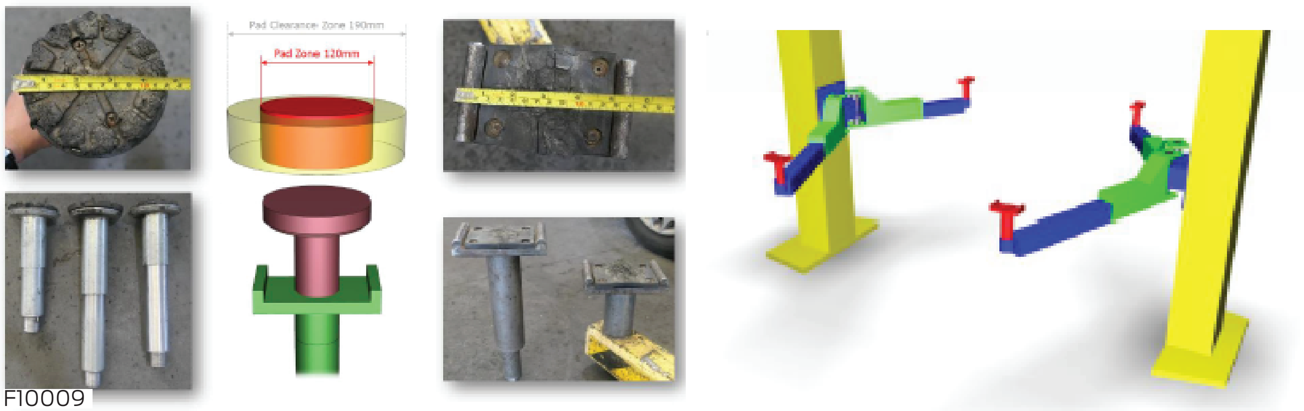
Front Hoist Locations

- Common for all variants
- Use of the "front step" body location either side
- Dependent on pad used, a block may need to be employed to avoid wheel arch liner damage

Rear Hoist Locations

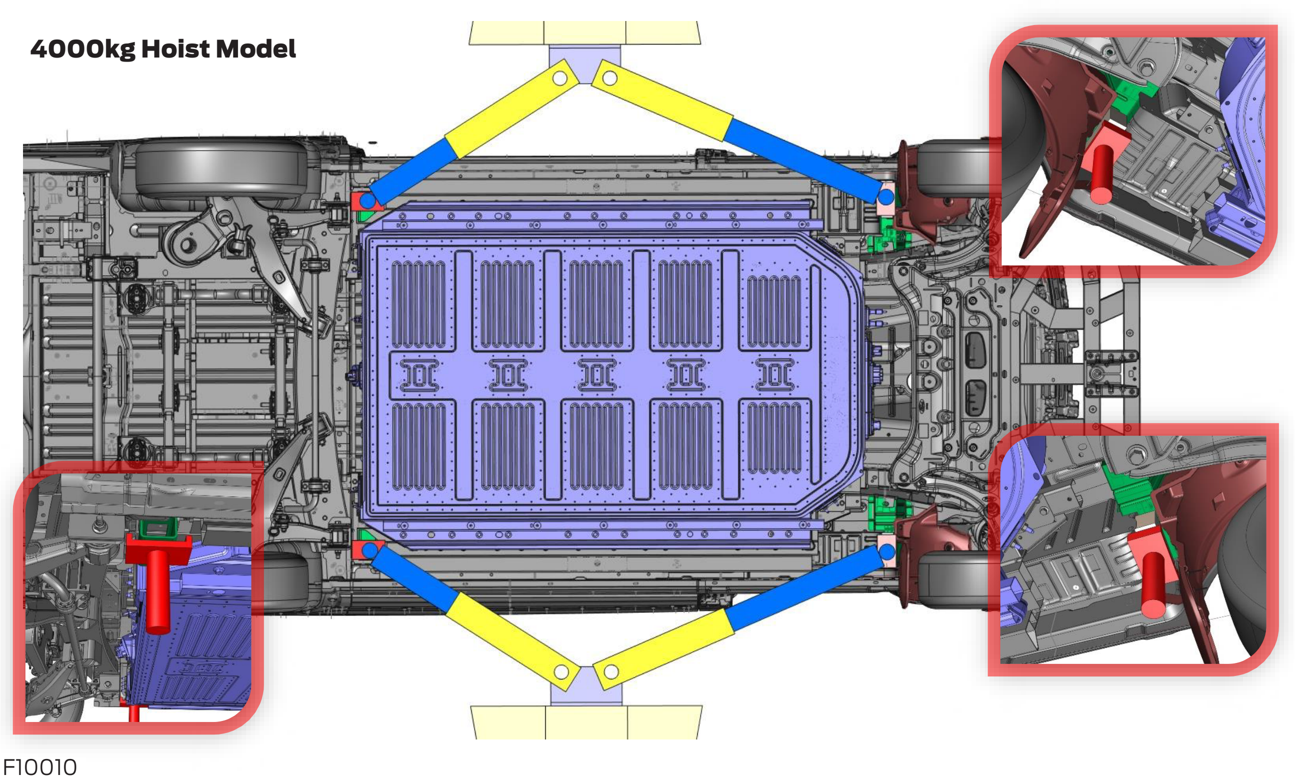
- Specific to variant
- L2 Van/Bus/Kombi - dedicated cradle lift pad
- L3/L4 Van/Bus/Kombi rail location
- L3/L4 Single Chassis Cab dedicated cradle lift pad
- All other Single Chassis Cab variants use rail location

Lift Pad and Dedicated Lift Cradle Pad



F10009

MWB Van, Bus, Kombi - Standard Range Battery



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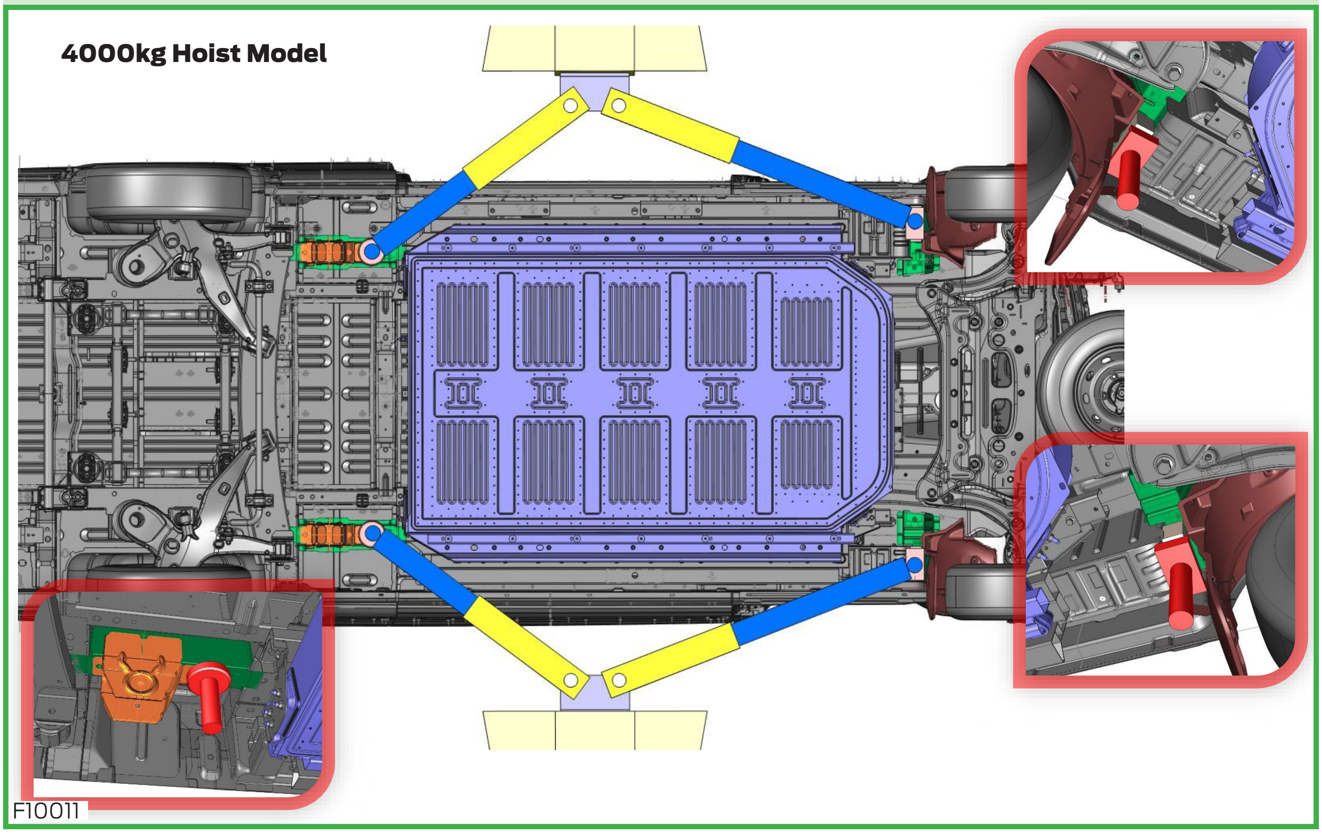
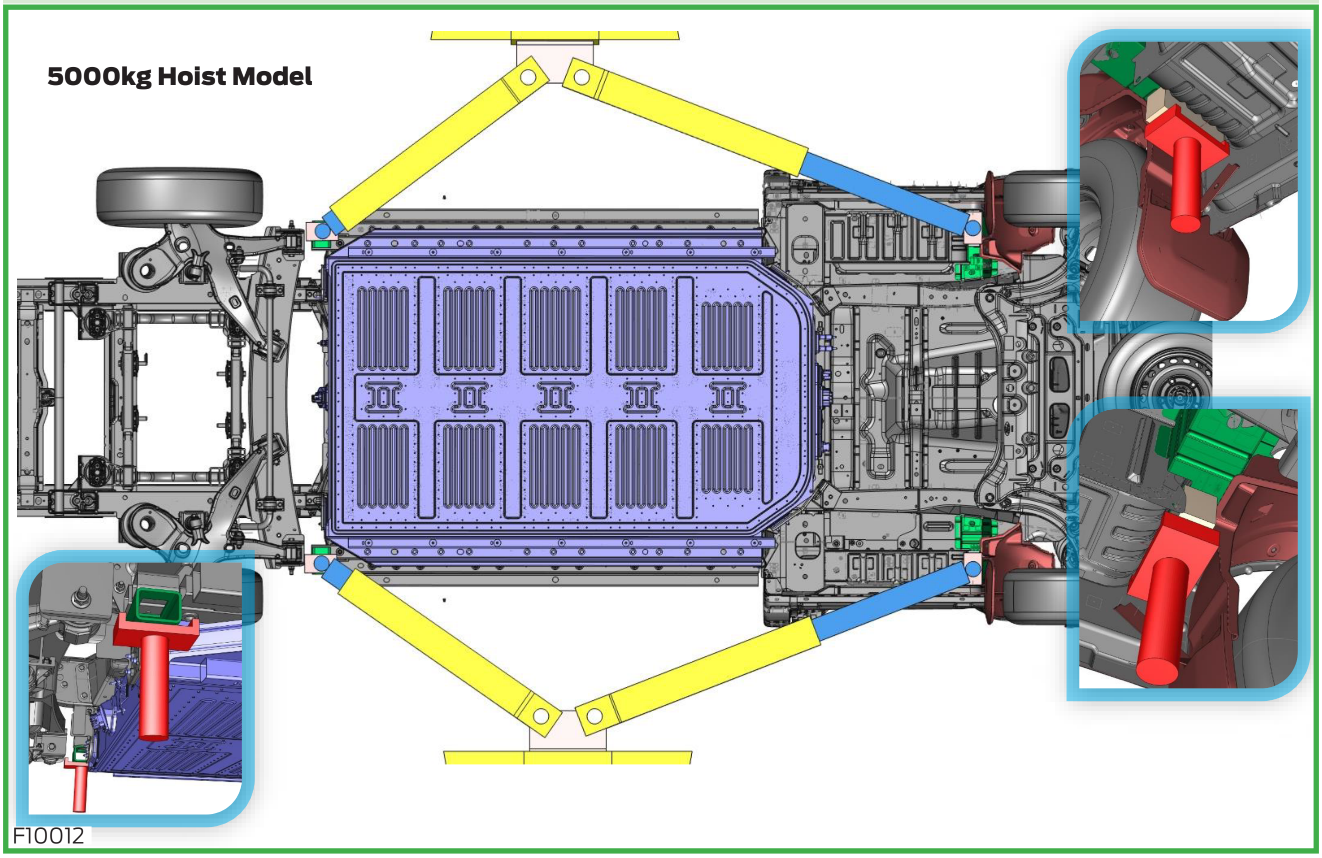
🟩 Abc = BEV Only 🟦 Abc = ICE Only

LWB Van, Bus, Kombi - Standard Range Battery

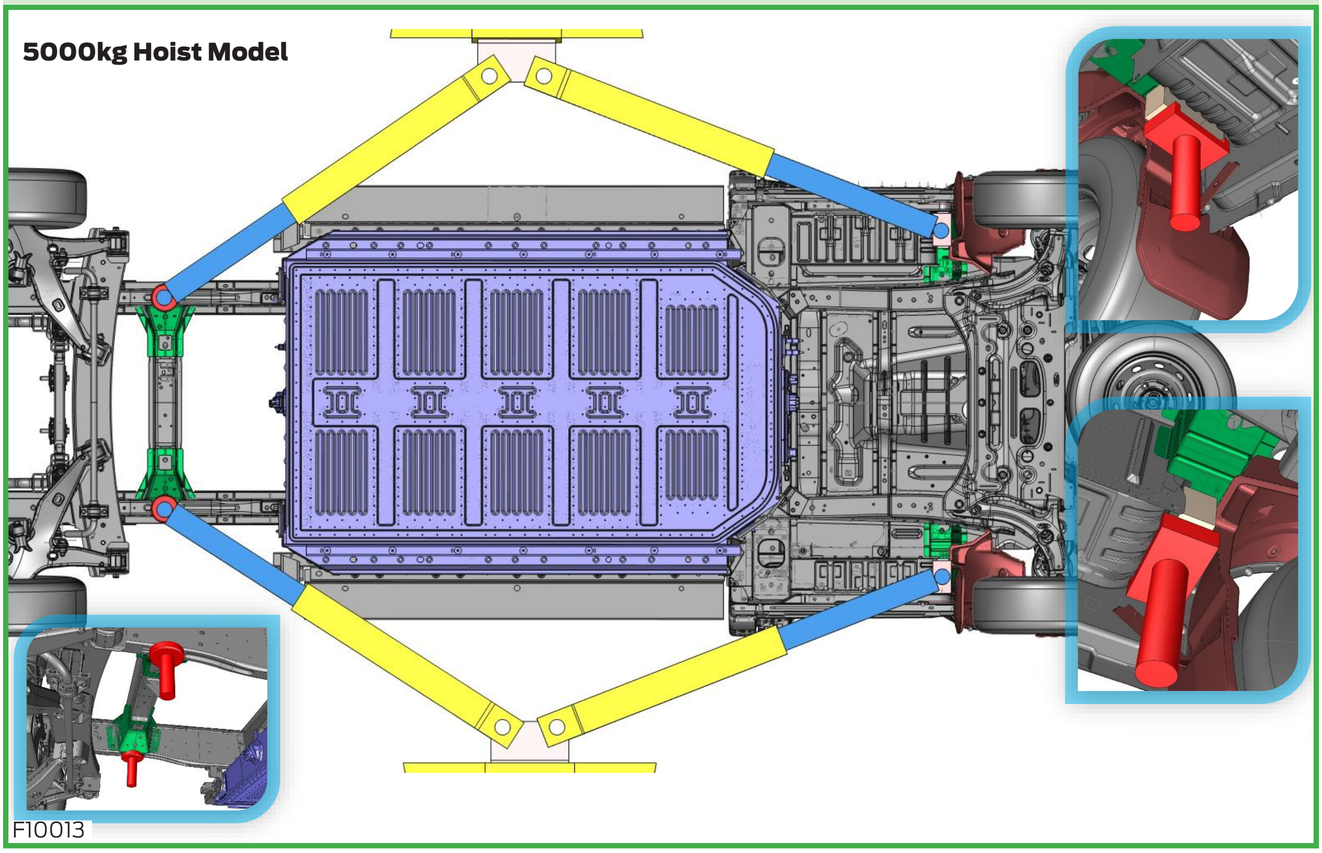

4000kg Hoist Model
F10011

LWB Single Chassis Cab - Standard Range Battery


5000kg Hoist Model
F10012

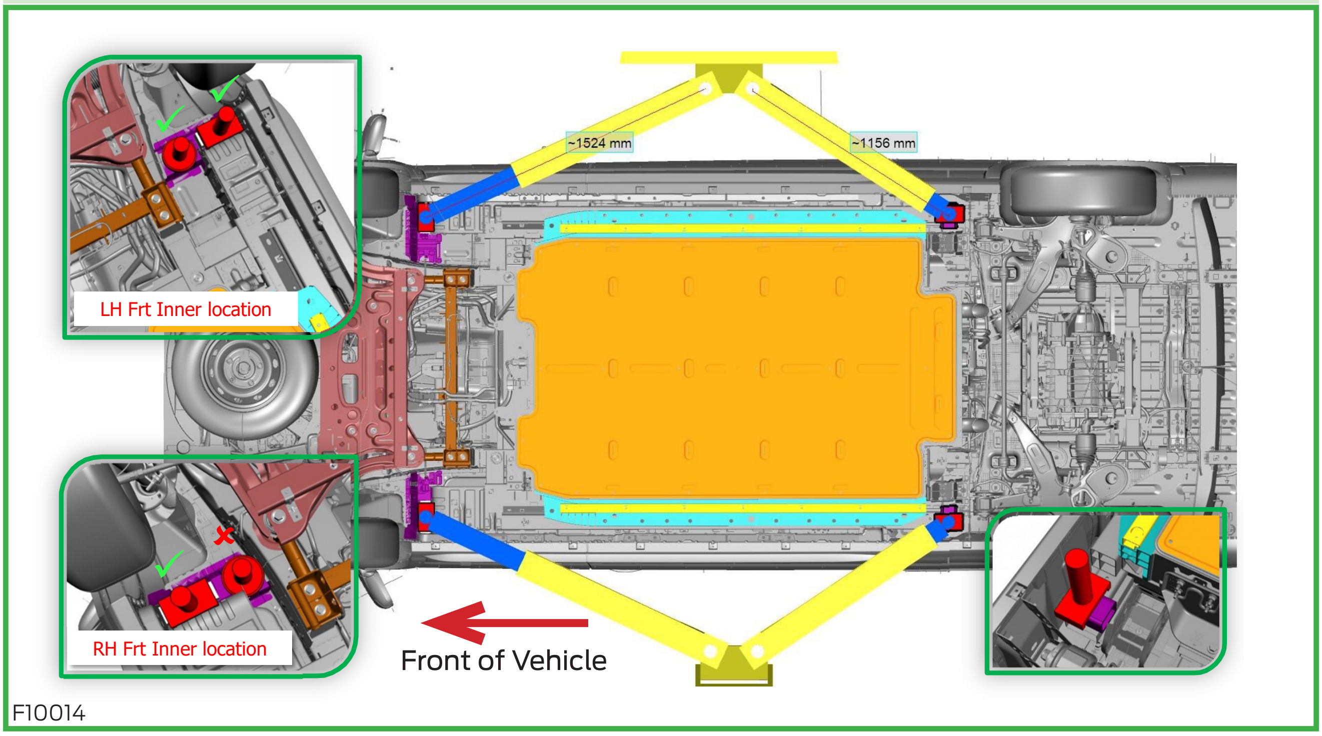
🟩 Abc = BEV Only 🟦 Abc = ICE Only

LWB EL Single Chassis Cab - Standard Range Battery


5000kg Hoist Model

F10013

LWB Van, Bus, Kombi - Enhanced Range Battery


~1524 mm
~1156 mm
LH Frt Inner location
RH Frt Inner location
Front of Vehicle

F10014

1.8 Noise, Vibration and Harshness (NVH)

⚠ **WARNING: Make sure that the modified vehicle complies with all relevant legal requirements.**

CAUTION: The travel and function of pedals must not be restricted.

Changes to the powertrain, engine, transmission, exhaust, air intake system or tires may influence the exterior noise emission. Therefore, the exterior noise level of the modified vehicle must be verified.

The interior noise levels should not be deteriorated by the modification. Reinforce panels and structures, as appropriate, to avoid vibrations. Consider the usage of sound deadening material on panels.

1.9 Vehicle Transportation Aids and Vehicle Storage

WARNING: Transport Mode will reduce the risk of spark plug fouling and catalyst damage from multiple starts without sufficient engine run time to warm the vehicle up to normal operating temperatures. There is a maximum number of starts allowed in Transport mode. Exiting Transport Mode prior to upfitting/ conversion increases the risk of spark plug fouling and/or catalyst damage.

CAUTIONS:

Disconnect the battery if the vehicle is to be stored for more than 7 days (ICE only).

For a storage period in excess of 30 days, disconnect the 12V Battery to maintain state of charge of the High Voltage battery (BEV only)

Make sure that the protective covers are not removed from an incomplete vehicle until the modification is started.

Make sure that components removed during modification are kept clean and dry.

Make sure that components removed during modification are refitted to the same vehicle.

If disconnected, make sure the 12 Volt battery negative cable is isolated or separated from the battery terminal to avoid unintended re-connection or arcing.

NOTE: If the 12 volt battery is disconnected, it will be necessary to reset memory features.

In addition:

- The windshield wipers should be lifted off the glass and set right up
- All air intakes should be closed
- To avoid flat-spotting, tire pressures should be increased but MUST NOT exceed the maximum tire pressure marked on the tire's side wall
- The parking brake system should not be used
- Apply suitable wheel chocks to prevent roll away
- Store vehicle between 32ºF (0ºC) and 113ºF (45ºC) if possible

A significant risk during storage is deterioration of vehicle bodywork, therefore, appropriate storage procedures must be observed, including periodic inspection and maintenance.

Claims arising from deterioration caused by incorrect storage, maintenance or handling are not the responsibility of Ford.

Vehicle Modifiers must determine their own procedures and precautions, particularly where vehicles are stored in the open, as they are exposed to any number of airborne contaminants.

The following may be considered a sensible approach to storage:

Short term storage (up to 14 days):

- Wherever possible, vehicles should be stored in an enclosed, dry, well-ventilated area. This area must be on firm, well drained ground which is free of long grass or weeds and where possible,
- protected from direct sunlight
- Vehicles must not be parked near, under foliage or close to water as additional protection may be necessary for certain areas of the vehicle

Long term storage (over 14 days):

- The battery should remain disconnected (initially disconnected after 7 days) but not removed from the vehicle
- The wiper blades should be removed and placed inside the vehicle. Make sure the wiper arms are suitably prevented from resting on the windshield
- Wheel trims (where fitted) should be removed and stored in the luggage compartment
- Place the automatic transmission in park position 'P' and release the parking brake completely. Chock the wheels first if the vehicle is not on level ground
- Set climate controls to the 'open' position to provide ventilation, where possible
- Where protective film has been applied at manufacturing it must be left on the vehicle until prepared for delivery but must be removed after a maximum storage period of six months (film is date stamped to indicate required removal date)
- Make sure that all windows, doors, hood, lift gate, tailgate, luggage compartment lid, convertible top and roof opening panel are completely closed and the vehicle is locked

The Pre-Delivery Inspection (PDI) is the final opportunity to make sure a battery is fit for purpose prior the customer taking delivery of their new vehicle. The battery must be checked and appropriate action taken prior to the vehicle being handed over to the customer. Test results must be recorded on the PDI repair order.

Batteries: To make sure the battery is maintained correctly and to assist in preventing premature failure, it is necessary to check and recharge the battery regularly while a vehicle is not in use. Where a battery is left below its optimum charge level for any length of time, it may result in premature failure of the battery.

Battery Drain Prevention: As part of the Vehicle Convertor process and to maximize battery life and prevent premature failure of the Ford batteries, protect and prevent battery discharge during any conversion or whilst the vehicle is in storage. This may include leaving the vehicle in Transport mode as long as possible, reducing the amount of crank cycling around the facility, door ajar events and duration. The voltage MUST be checked when receiving and before shipping. Recharge with an appropriate proprietary battery charger if the vehicle battery voltage is below 12.4V for Standard and Enhanced flooded or 12.3V for AGM. Measure connected to the vehicle at ignition off and no loads active including interior or exterior lights in Off status.

Subsequent stage manufacturers and vehicle alterers who will be working with BEV vehicles should develop a plan to potentially charge these vehicles.

Charging stations may be particularly important at vehicle receiving locations in case vehicles arrive with insufficient charge to maneuver through the manufacturing process.

Charging stations are recommended at vehicle storage locations

Upfitters should also consider the vehicle state of charge as it leaves their facility:

- BEV vehicles upfit as ship-thrus should enter the Ford transportation system with the same state of charge they had leaving the Ford assembly plant.
- In other cases, upfitters should consider their customer's expectations and transportation arrangements when determining any state of charge requirements.

Refer to: 4.5 Battery and Cables

Transport Mode

After a new vehicle is built, some modules are set in "Transport Mode", which disables or alters various systems to reduce battery drain. The vehicle message center displays "Transport Mode Contact Dealer" while in this state. The vehicle will automatically progress to normal operation after it has been driven 125 miles (201km), or it can be manually advanced by the following procedure:

1. Start with a fully charged 12v battery and ignition in the OFF position
2. Place the ignition in the ON position
3. Press and release the brake pedal 5 times
4. Press and release the hazard switch 2 times

Note: Step 3 and 4 must be carried out within 10 seconds. The vehicle message center indicates "Normal Mode" when the process has been successfully completed. Once in Normal Mode, Transport Mode cannot be restored.

Action/Time in Storage	Monthly	Every 3 Months
Check vehicle is clean	X	-
Remove external contamination	X	-
Check battery condition — Recharge if necessary	X	-
Visually check tires	X	-
Check interior for condensation	-	X
Run engine for 5 minutes minimum with air conditioning switched on, where applicable (ICE only)	-	X

1.10 Package and Ergonomics

1.10.1 General Component Package Guidelines

⚠ **WARNING: Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe or anti-roll bars, springs or shock absorbers including mounting brackets.**

The Vehicle Modifier must ensure that sufficient clearance is maintained, under all drive conditions, to moving components such as axles, fans, steering, braking system etc.

The Vehicle Modifier is responsible for all installed components during the modification. The durability has to be confirmed by appropriate test procedures.

1.10.2 Driver Reach Zones

Controls and/or equipment required to be used while driving should be located within easy reach of the driver so as not to impair driver control.

1.10.3 Driver Field of View

⚠ **WARNING: Make sure that the modified vehicle complies with all relevant legal requirements.**

1.10.4 Conversion Effects on Parking Aids

⚠ **WARNING: Ensure that monitors mounted in the cabin meet the interior package and safety requirements.**

⚠ **System will not function if an aftermarket rear step or other rear mounted equipment is installed. Reverse Brake Assist feature will not automatically brake when a collision is imminent**

On modifications requiring a rear camera, the reverse signal may be taken as detailed in the electrical section, described in ‘reversing lamps’.

Refer to: 4.12 Exterior Lighting

1.10.5 Aids for Vehicle Entry and Exit

Grab Handles

⚠ **WARNING: Make sure that the location of the no-drill zones are checked before drilling.**

ⓘ **CAUTION: Make sure that reinforcements are installed to maintain the integrity of the original body structure.**

1.10.6 Vehicle Dimensions

Depending on the body style, Transit is available in 3 Wheelbases and 3 Roof Heights

Wheelbases:

- Regular Wheelbase
- Long Wheelbase
- Extended-Length Long Wheelbase

Roof Heights:

- Low
- Medium
- High

For further information please go to the Body Builders Advisory Service, for 2024 Transit Specs (Dimensions and Capacities)

1.10.7 Chassis Cab Body Extensions

WARNINGS:

⚠ **Do not modify the wheelbase.**

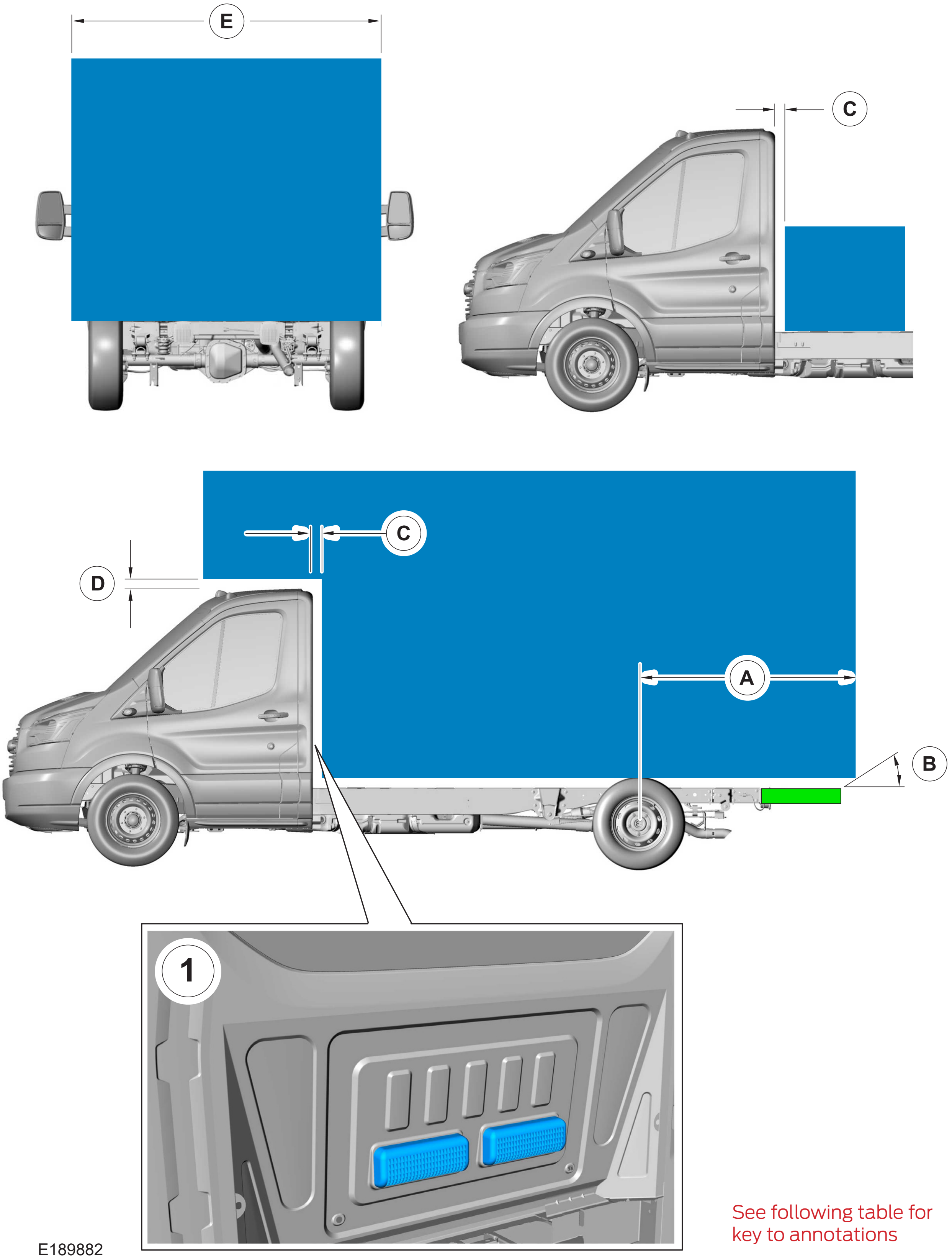
⚠ **Do not allow Center of Gravity of the body payload to fall behind the rear axle center line.**

NOTE: Extreme rear overhang may encourage unacceptable loading conditions, which could unload the front axle producing unacceptable handling and braking characteristics.

NOTE: For frontal area restrictions for completed Chassis Cabs and Cutaways, please see the Incomplete Vehicle Manual in the ‘Publications’ section of the BBAS website https://fordbbas.com

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Chassis Cab Body



See following table for key to annotations

Rear Frame Extensions

Description		**RWB -138” (3505mm)**	**LWB -156” (3962mm)**	**EL-LWB - 178” (4521mm)**
Maximum Rear Frame Extension		30” (762mm)	50” (1270mm)	80” (2032mm)(1)
Rear axle to end of frame, not including frame adapter		37.35” (948.8mm)		
A	Maximum recommended rear overhang(1) considering CoG of body and payload is not rearwards of the rear axle centerline and requirements of masses and dimensions regulation.	67.35” (1710.8mm)	87.35” (2218.8mm)	117.35” (2980.8mm)
B	Ensure local lighting legislation is maintained (F/CMVSS 108)(2)			
C	1.18” (30mm) minimum clearance between the back of the cab and the second unit body			
D	1.18” (30mm)			
E	Maximum external body width(1)	Short Arm Mirrors - 86” (2185mm)(2)		
		Long Arm Mirrors - 96” (2439mm)(2)		
1	Vents must be free from obstruction			

RWB = Regular Wheelbase, LWB = Long Wheelbase, EL-LWB = Extended-Length Long Wheelbase, CoG = Center of Gravity

(1) > 60” (1524mm) extensions require additional cross members.

(2) Vehicle Modifiers must ensure that unique second unit body upfits comply with the appropriate F/CMVSS and emissions requirements as specified in the Incomplete Vehical Manual (IVM)l.

Refer to: 5.15 Frame and Body Mounting

All drag reduction devices that the second unit body vehicle modifiers add should not exceed the maximum frontal area and width as specified in the Incomplete Vehicle Manual (IVM).

1.11 Hardware

Material Specification, Strength and Torque

Standard Hardware and Tightening Torques (Nm) Bolts/Studs: ISO 898-1, Nuts: ISO 898-2				
Thread Size	**Grade 8.8**		**Grade 10.9**	
	Minimum	**Maximum**	**Minimum**	**Maximum**
M5	5.2	7.2	5.9	8.1
M6	8.9	12.1	10.2	13.8
M8	21.2	28.8	25.5	34.5
M10	40.3	54.7	53.1	71.9
M12	68.0	92.0	93.5	126.5
M14	113	153	148.7	201.3
M16	170.0	230.0	233.7	316.3

This torque chart is a recommendation and the convertor is responsible for the optimal torque for a specific joint.

1.12 Load Distribution

1.12.1 Load Distribution

WARNINGS:

Overloading of the vehicle could result in unacceptable ground clearance.

The center of mass of the payload should be located within the wheelbase of the vehicle.

Avoid one-sided load distribution.

Uneven load distribution could result in unacceptable handling and braking characteristics.

Load distribution outside of the permitted range may result in unacceptable steering, handling and braking characteristics.

Do not exceed the total gross weight mass, which must include curb weight, driver, all passengers and additional loads to the vehicle.

CAUTIONS:

Do not exceed the axle plated weights.

Do not exceed the gross vehicle weight.

In rear wheel drive (RWD) single rear wheel (SRW) vehicles, the front axle load must, in all load cases, exceed 36% of the actual vehicle weight.

In RWD dual rear wheel (DRW) vehicles, the front axle load must, in all load cases, exceed 30% of the actual vehicle weight.

1.12.2 Center of Gravity Position

The position of the center of gravity is changed when masses are added or removed from the vehicle. This may influence the steering characteristics, handling behavior and the brake performance.

Do not raise the center of gravity beyond specified limits or the vehicle may become unstable and dangerous.

Lateral Position

It is important to keep the Center of Gravity laterally within given limits.

Lateral Center of Gravity is determined by the vertical wheel forces difference, right (front right mass added to rear right mass) to left (front left mass added to rear left mass).

For any lateral position information please refer to the IVM.

Vertical Position - Center of Gravity Height

The Center of Gravity Height of the vehicle is determined by the mass of the base delivered vehicle and the added and removed masses. In physics this relation is described by the Steiner's theorem.

The Center of Gravity Height influences axle weights while braking. Center of Gravity height influences roll stability.

1.12.3 Center of Gravity Height Test Procedure

Measurement

Vehicle Center of Gravity calculation is required to determine compliance with F/CMVSS 105 Brakes and F/CMVSS 126 Electronic Stability Control. Maximum allowable Vertical Center of Gravity values for these standards can be found in the Incomplete Vehicle Manual: https://fordbbas.com.

In order to check the center of gravity height, the following described method is proposed:

For this test four scales are required. The test is possible with two scales but this requires more preparation and it results in lower accuracy.

Initially the vehicle weights needs to be measured in a horizontal position. Afterwards the front is lifted and weights measured again. The higher it is lifted the more accurate the results will be. The height is restricted by different possible touch conditions: between vehicle parts and roof, ground and environment.

In order to improve measurements, following preparations need to be done:

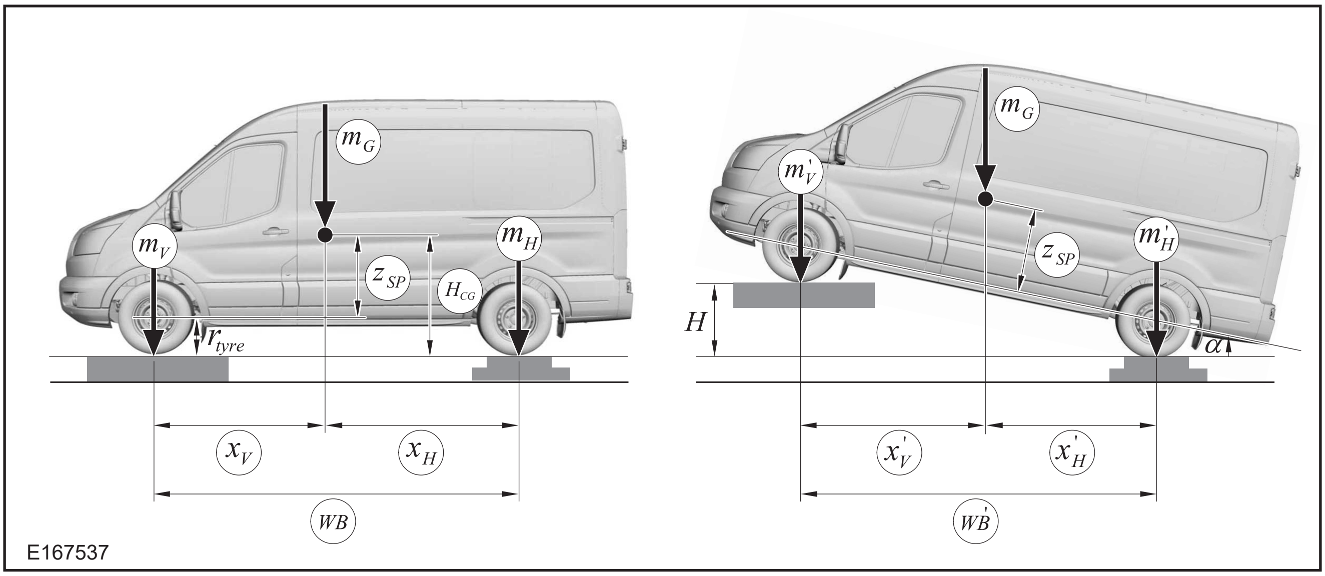
- Fix wheel travel, for example: solid shocks, or spring fixes
- Increase tire pressure to maximum allowed value
- It is important to remove all load - for example, moving items - from the vehicle or it should be properly fixed
- Doors should be closed

Before measuring the vehicle, the engine must be switched off. After lifting, it should be rolled freely in order to release tension in the tires and suspension.

Calculation

In order to estimate the resulting Center of Gravity (CG_v) the axle load needs to be measured twice. The first measurement is in the horizontal plane and the second measurement is after the front is lifted. To get a consistent result, this test should be done 3 times independently with different heights.

To improve accuracy the test is done additionally the other way around, where the rear end is lifted.



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Variables, to be measured, calculated or known			**Measurement**		
			1st	**2nd**	**3rd**
Wheelbase	WB	mm			
Front Axle Weight	m_V	kg			
Rear Axle Weight	m_H	kg			
Total Mass	$m_G = m_V + m_H$	kg			
Inclined Vehicle					
Front Axle Weight	m'_V	kg			
Rear Axle Weight	m'_H	kg			
Height (Lift)	H	mm			
Inclination Angle		deg			
Center of Gravity Height Z		mm			

Inclination Angle:

$$\alpha = \arcsin\left[\frac{H}{WB}\right].$$

E146623

Center of Gravity Height Z:

$$z_{SP} = \frac{m_H - m'_H}{m_G \cdot H} \cdot WB^2 \cdot \cos\alpha$$

$$z = H_{CG} = z_{SP} + r_{tyre}$$

E146624

1.12.4 Center of Gravity Height Calculation

Given or measured parameter	
Wheelbase	WB
Front axle weight	m_V
Rear axle weight	m_H
Front height	H
Calculated and auxiliary parameter	
Center of Gravity (CoG) height	Z_{SP}
Total vehicle mass	m_G
Distance front axle to CoG (horizontal)	X_V
Distance rear axle to CoG (horizontal)	X_H
Wheelbase (projected in horizontal)	WB'
Front axle weight	m'_V
Rear axle weight	m'_H
Distance front axle to CoG (projected in horizontal direction)	X'_V
Distance rear axle to CoG (projected in horizontal direction)	X'_H
Inclination angle	arc sin
Front part of 'distance rear axle to CoG (horizontal)'	X_{H1}
Rear part of 'distance rear axle to CoG (horizontal)'	X_{H2}

1.12.5 Formulas

- Masses and lengths. Total vehicle mass is the sum of front and rear axle weights:
- $m_G = m_V + m_H$

The longitudinal distances between the Center of Gravity and the centers of wheels equal:

$$x_V = \frac{m_H}{m_G} WB$$

$$x_H = \frac{m_V}{m_G} WB$$

E146626

In inclined system, the main variable is the inclination angle, which is the quotient of the lifting height and the wheelbase:

$$\sin \alpha = \frac{H}{WB}$$

E146627

Similar to the equation for the horizontal system, the distance projected in to the ground plane can be determined using the sum of moments around front and rear wheel center:

$$x_V^{'} = \frac{m_H^{'}}{m_G} WB^{'}$$

$$x_H^{'} = \frac{m_V^{'}}{m_G} WB^{'}$$

E146628

The following equations apply:

$$WB^{'} = WB \cos\alpha$$

$$x_{H2} = \frac{x_H^{'}}{\cos\alpha}$$

$$x_{H1} = x_H - x_{H2}$$

E146629

Using the rule of proportion leads to the Center of Gravity height formula:

$$\frac{x_{H1}}{z_{SP}} = \frac{H}{WB'}$$

$$\boxed{z_{SP} = \frac{m_V - m_V^{'}}{m_G \cdot H} \cdot WB^2 \cdot \cos\alpha} \;, \; \alpha = \arcsin\left[\frac{H}{WB}\right]$$

or

$$\boxed{z_{SP} = \frac{m_H^{'} - m_H}{m_G \cdot H} \cdot WB^2 \cdot \cos\alpha} \;, \; \alpha = \arcsin\left[\frac{H}{WB}\right]$$

E146630

1.13 Towing

E-Transit Battery Electric Vehicle (BEV)

⚠ **WARNING: No tow bars are to be fitted to the E-Transit BEV**

The vehicle has no towing capability due to the risk of damaging the High Voltage motor during braking.

If planning to retrofit a Tow Hitch to extended wheel base vans and wagons, ensure Trailer Wiring Prep Pack (order code 59B) is ordered on the vehicle.

NOTE: Wiring Prep Pack (59B) only guarantees support for trailer lighting.

NOTE: If trailer brake functionality is required order Trailer Brake Controller (67D). Heavy Duty Trailer Tow (53B) provides connector in instrument panel for add on trailer brake controller.

NOTE: See Trailer Brake Controller (67D) for requirements necessary for addition of trailer lighting capability on capable vehicles.

NOTE: There is no wiring provisions for Trailer Tow operations provided on the base vehicle.

For additional details regarding components necessary for the addition of trailer lighting capability on capable vehicles:
Refer to: 4.2 Wiring Installation and Routing Guides Electrics for Tow Bar section.

NOTE: Tow Haul Mode is only available when ordering Trailer Tow packages 59B or 53B

For availability please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at BBAS@ford.com

2.1 Suspension System

WARNINGS:

⚠ **Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe or anti-roll bars, springs or shock absorbers including mounting brackets.**

⚠ **Interchangeability (including between different Transit variants) of springs, shock absorbers and jounce bumpers is not permitted as the changes in vehicle dynamic performance can affect the ESP system.**

(!) **CAUTION: Modifications to the suspension system can cause a deterioration of the vehicle handling characteristics and durability.**

NOTE: For further information please contact the Body Builders Advisory Service at bbasqa@ford.com

2.2 Front Suspension

2.2.1 Springs and Spring Mounting

WARNINGS:

⚠ **Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe or anti-roll bars, springs or shock absorbers including mounting brackets.**

⚠ **Interchangeability (including between different Transit variants) of springs, shock absorbers and jounce bumpers is not permitted as the changes in vehicle dynamic performance can affect the ESP system.**

CAUTIONS:

❗ **When carrying out welding work the springs must be covered to protect them against weld spatter.**

❗ **Do not touch springs with welding electrodes or welding tongs.**

❗ **Make sure that components loosened or removed and reinstalled are properly reassembled and the torque set in accordance with manufacturer’s requirements.**

NOTE: Do not modify the wheelbase or track width or add any type of frame extension.

NOTE: Do not damage the surface or corrosion protection of the spring during disassembly and installation.

NOTE: For further information please contact the Body Builders Advisory Service at bbasqa@ford.com

2.3 Rear Suspension

2.3.1 Springs and Spring Mounting

WARNINGS:

⚠ **Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, sub-frame, springs or shock absorbers including mounting brackets.**

⚠ **The rear leaf springs are pre-stressed in manufacture and should not be altered for rate or height in any way during vehicle conversion. Adding or removing leaves (or any other spring type) may result in failure or reduced function of the spring as well as other vehicle related issues for which Ford Motor Company cannot be held responsible.**

⚠ **The rear coil springs on E-Transit are pre-stressed in manufacture and should not be altered for rate or height in any way during vehicle conversion. Modification of any suspension component may result in failure or reduced function of the spring as well as other vehicle related issues for which Ford Motor Company cannot be held responsible.**

⚠ **Interchangeability (including between different Transit variants) of springs, shock absorbers and jounce bumpers is not permitted as the changes in vehicle dynamic performance can affect the ESP system.**

CAUTIONS:

When carrying out welding work the springs must be covered to protect them against weld spatter.

Do not touch springs with welding electrodes or welding tongs.

Make sure that components loosened or removed and reinstalled are properly reassembled and the torque set in accordance with manufacturer's requirements.

NOTE: Do not modify the wheelbase or track width or add any type of frame extension.

NOTE: Do not damage the surface or corrosion protection of the spring during disassembly and installation.

NOTE: Do not add any additional axles.

NOTE: For further information please contact the Body Builders Advisory Service at bbasqa@ford.com

Rear Anti Roll Bar

The following vehicles have rear anti roll bars:

- Single rear wheel (SRW) long wheelbase Wagon.
- All dual rear wheel (DRW) vehicles.

2.4 Wheels and Tires

2.4.1 Wheel Clearance

The distance from the tire to the mudguard or wheel arch must be sufficient, even if snow or anti-skid chains are fitted and the suspension is fully compressed allowing for axle twist as well.

NOTE: Make sure that only approved wheels and/or permissible tire sizes are fitted.

NOTE: Ensure access to the wheel and wheel jack and provide sufficient clearance in the wheel arch to allow changing the wheels after modification.

NOTE: Maintain access to the spare wheel winch on Chassis Cab/Cutaway via the hole in the side rail, under all loading conditions.

For standard wheelhouse dimensions:
Refer to: 5.1 Body

2.4.2 Tire Pressure Monitoring System (TPMS)

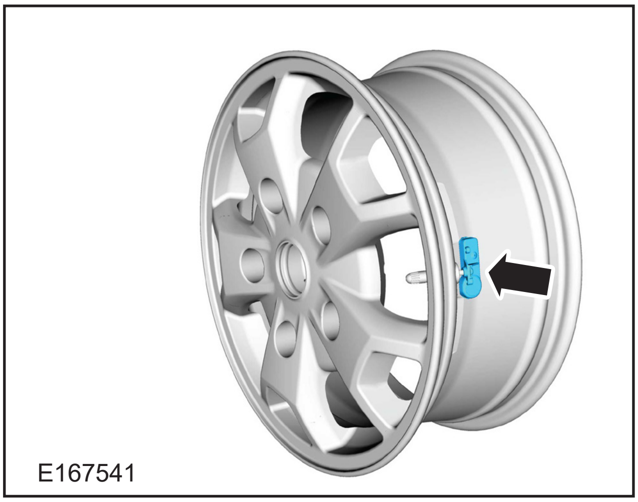
Ford TPMS is a direct system, using physical pressure sensors. TPMS is calibrated according to the correct tire pressure for the GVWR of the vehicle. If the spare wheel is ordered on a base vehicle with TPMS, the tire will not be supplied with a TPMS sensor.

If you need to replace a road wheel and tire with the temporary spare wheel, the system will continue to identify a defect. This is to remind you to repair and refit the damaged road wheel and tire to your vehicle. To restore the correct operation of the system, you must have the repaired road wheel and tire refitted to the vehicle.

NOTE: If fitting new tires, you must ensure that the TPMS sensors are fitted correctly. For further information refer to the Owner's Manual, Ford Shop Manual or contact your Local Ford Dealer.

The TPMS receiver is located in the overhead shelf and points directly towards the rear doors.

For additional information Refer to: 4.22 Handles, Locks, Latches and Entry Systems



2.4.3 Spare Wheel

When modifying or relocating the spare wheel, access must be ensured.

2.4.4 Painting Road Wheels

CAUTION: Do not paint wheel clamp surfaces in contact with other wheels, brake drum or disc, hub and holes, or surfaces under wheel nuts. Any further treatment in these areas may affect the wheel clamp performance and the vehicle safety.

Mask the wheel when changing the color or repairing paint.

2.5 Brake System

2.5.1 General

The Brake System must be fully functional when the vehicle modification is completed. The vehicle brake operating modes must be checked, including warning system and parking brakes.

Brakes are certified to F/CMVSS 105 on completed vehicles. Guidance for complying with F/CMVSS 105 on incomplete vehicles is provided in the Incomplete Vehicle Manual.

WARNING: Do not restrict the airflow and cooling to the brake system.

CAUTIONS:

Spoilers and wheel covers must not affect the brake cooling performance.

For converted vehicles fitted with AEBS (Advanced Emergency Braking System), where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment and system functionality is checked by a Ford dealer. For further information, refer to the Workshop manual or Owner's manual.

NOTE: Do not obstruct the view of the brake fluid reservoir level.

NOTE: The donor vehicle brake fluid reservoir is translucent so that it is possible to check the level of fluid without opening the reservoir which will reduce the risk of contamination. Do not move the brake fluid reservoir.

NOTE: Do not obstruct the radar. Refer to: 4.15 Adaptive Cruise Control

The brake fluid reservoir must remain accessible for servicing and for adding brake fluid.

2.5.2 Brake Hoses General

CAUTION: Make sure that the front and rear brake hoses are not twisted and are correctly located away from body and chassis components.

Front and rear brake hoses must not rub, chafe or rest on body or chassis components. There must be clearance under all operating conditions, between full compression and extension and full lock to lock.

Brake lines must not be used to support or secure any other component.

2.5.3 Parking Brake

WARNINGS:

Do not modify the brakes.

Do not splice into the parking brake cable.

Do not modify the Electronic Parking Brake

CAUTION: Make sure that a new parking brake cable is fitted if modification impacts the existing parking brake cable.

2.5.4 Hydraulic Brake - Front and Rear Brakes

WARNINGS:

Do not modify the brakes.

Do not modify the disc inflow and outflow of cooling air.

2.5.5 Anti-Lock Control — Stability Assist

WARNING: Do not modify any part of the braking system, including Anti-lock Brake System (ABS), Traction Control System (TCS) and Electronic Stability Control (ESC), also known as Electronic Stability Program (ESP).

NOTE: For further information please go to the Body Builders Advisory Service, https://fordbbas.com, or email bbasqa@ford.com

🟩 Abc = BEV Only 🟦 Abc = ICE Only

3.1 Engine/E Drive

CAUTION: Make sure to follow the equipment supplier's instructions for safety, warranty and sometimes legal compliance.

For E-Transit BEV, do not modify the Electric Drive Assembly

For E-Transit BEV, do not modify the Halfshafts in the Electric Drive Assembly

For electrical supply to auxiliary equipment.
Refer to: 4.4 LV Charging System (12V)

3.1.1 Engine Types/E Drive Types

Engine/E-Drive	Max Power HP or kW/RPM	Max Torque lb-ft/RPM	Emissions	Transmission
RWD				
PFDI Gasoline 3.5L	275 HP @ 6000 rpm	260 lb-ft @ 4250 rpm	50 State	10 SPD AUTO (10R80)
EcoBoost Gasoline 3.5L	310 HP @ 5500 rpm	400 lb-ft @ 2500 rpm	50 State	10 SPD AUTO (10R80)
E-RWD				
Standard Range Battery	135kW (184PS)	317 lb-ft	Zero	1 SPD AUTO
Enhanced Range Battery	198kW (269PS)	317 lb-ft	Zero	1 SPD AUTO

3.2 Engine Cooling

3.2.1 Auxiliary Heater Systems

WARNINGS:

⚠ **Ford coolant additives are necessary for the complete function of the system. Only use Ford approved or equivalent specification component, to withstand any detrimental effects on the materials.**

⚠ **Do not mount components in front of the grille or in an area of air flow around the engine, which could affect the engine cooling.**

CAUTIONS:

❗ **Only make connections into the heater hose between the front cab heater and water pump return inlet.**

❗ **Do not exceed the vehicle's original coolant volume (without prep. pack and auxiliary heater) by more than 10%.**

❗ **Maintain a coolant level between maximum and minimum line in cold condition after fill and de-aerating operations.**

❗ **Only use the manufacturer recommended (or equivalent specification) coolant additives/anti-freeze. Do not mix coolant types.**

- Coolant flow to cab heater must have priority over flow to auxiliary heater or hand wash facility
- Coolant tube routing must be below the minimum line of the degas bottle
- Tube routing must be secured to the body structure or suitable brackets avoiding electrical components or wires, hot or moving parts and brake or fuel system components
- Hose must be heat sleeved with appropriate material if within 3.9" (100mm) of exhaust components (for example, manifold or exhaust gas recirculating)
- The vertical clearance between the critical cooling components (radiator, fan shroud and radiator brackets) and both the hood inner and outer (assembly) panels at design position shall not be less than 0.6" (15mm)
- There must be a minimum clearance of 0.4" (10mm) between the engine assembly and flexible components (for example, hoses or wiring harnesses) affixed to front end sheet metal hardware, under a maximum engine torque roll condition

For auxiliary heater and A/C installation use climate control prep-pack. The prep-pack is available for Van/Wagon Prep and Cutaway vehicles.

Base Package (62C)

- A/C refrigerant line prep lines
- Heater prep lines

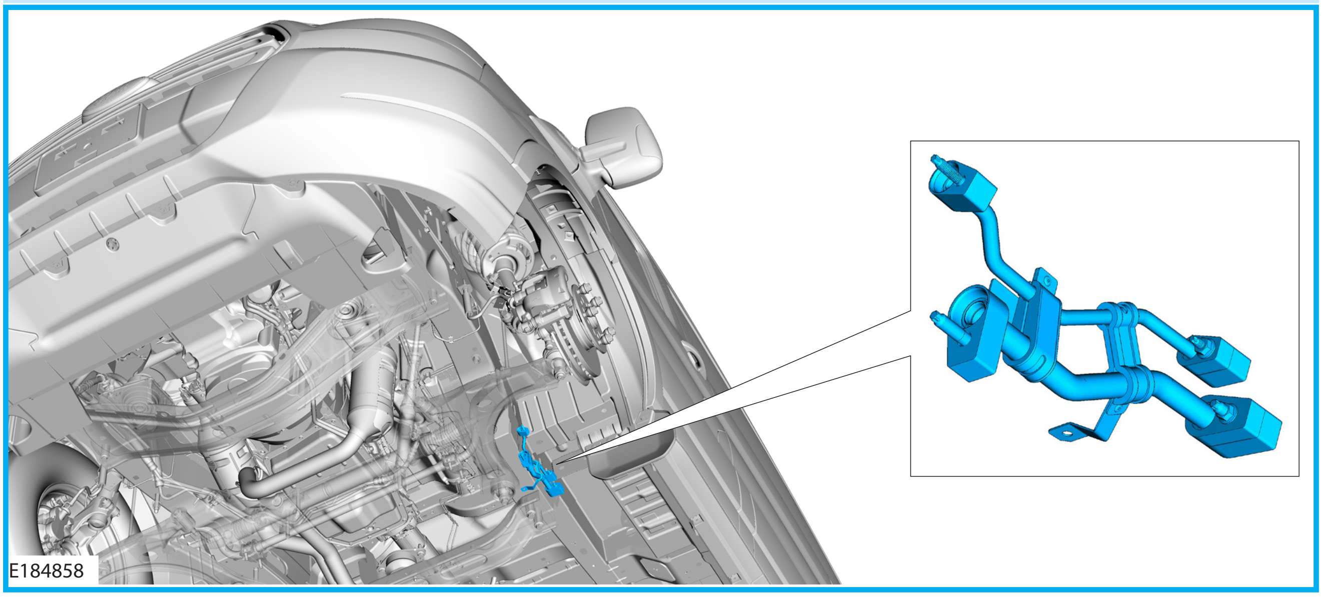
Connecting to the OEM A/C System

- A/C taps are located beneath the drivers side 'B' Pillar
- Recover R-134a and measure any oil removed • Remove metal seal fitting blank and replace with female metal seal fitting
- Replace rubber seals for any metal seal fitting being serviced
- Complete addition of auxiliary system
- Charge system and replace the oil

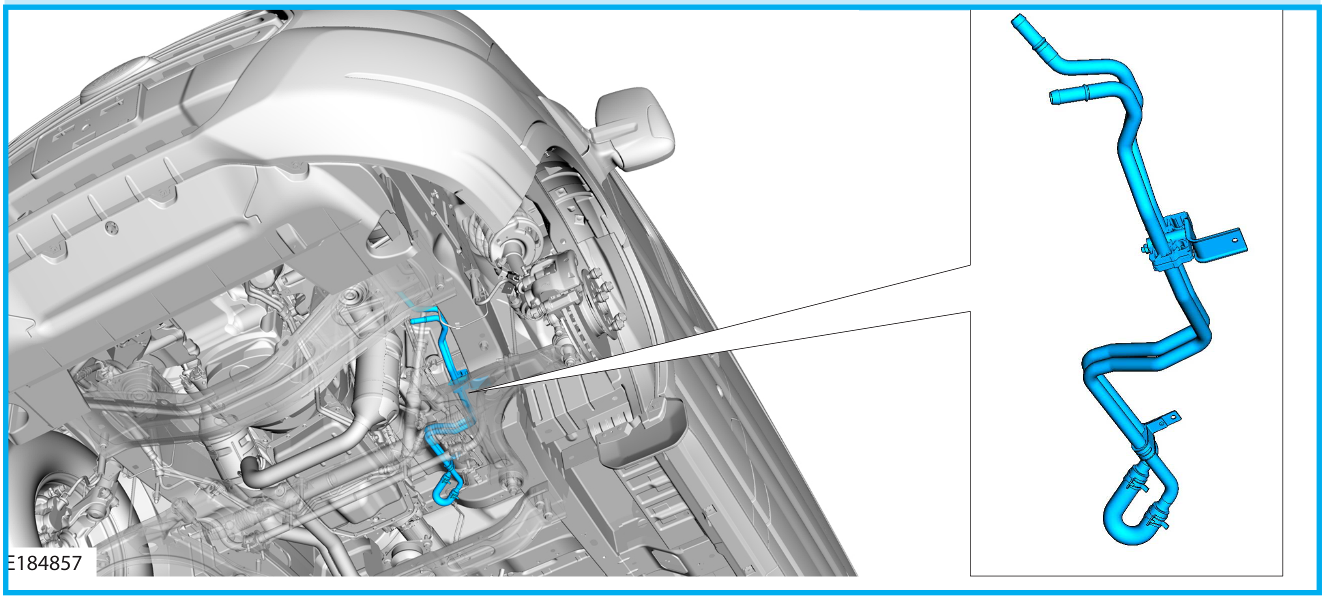
Connecting to the OEM Heater System

- Clamp the heater lines upstream of the prep-pack system
- Remove 180º U-Bend and restriction from the end of the prep-pack lines by removing the tension clamps
- U-Bend contains a restriction to prevent loss of

Common A/C Prep-Pack



Gasoline Heater Prep-Pack



For prep-pack connections see Workshop Manual

coolant flow to the front HVAC
  - the bottom, car rearward coolant line supplies the hot coolant
- Complete addition of the auxiliary heater system
- Replace 50/50 coolant and water mixture
- De-aerate coolant systems as per Workshop Manual

Aftermarket Rear Auxiliary A/C and Rear Heater Guidelines

A/C System

- The auxiliary system must use a TXV expansion system and must be properly sized to maximize performance
- Refrigerant shut off valves are not recommended

Heater System

- Coolant temperature must be able to maintain 158ºF (70ºC) throughout normal operation

A/C Prep-Pack Constraints

- Do not operate the A/C compressor prior to the installation of an auxiliary unit. This will cause oil to accumulate in the prep-pack lines and starve the compressor of oil
- Keep maximum defrost use to a minimum as this also uses the compressor to de-humidify the air

3.2.2 Fuel Fired Auxillary Heaters

Ensure that the exhaust gas from any auxiliary heating system cannot be re-circulated into the vehicle. The exhaust gases must not pass into the engine intake system or the air intake for the passenger compartment ventilation. The heating system should be installed outside the passenger compartment. The location of the heating system should not be in close proximity to movable components. Any body reworks which damage the paint must be fully protected against corrosion.

Refer to: 5.14 Corrosion Prevention

3.2.3 Air Flow Restrictions

⚠ **WARNING: Do not mount components in front of the grille or in an area of air flow around the engine, which could affect the engine cooling performance.**

❗ **CAUTION: Overheating within the engine compartment can seriously compromise component robustness.**

NOTE: Please assume under hood environment is about 266ºF (130ºC) when selecting appropriate materials.

NOTE: For further information please contact the Body Builders Advisory Service at https://fordbbas.com,

3.3 Accessory Drive

3.3.1 Front End Accessory Drives (FEAD) — General Information

When the correct belt is used, tensioning is and remains fully automatic for the life of the belt.

CAUTIONS:

Only use the manufacturer's recommended (or equivalent specification) components.

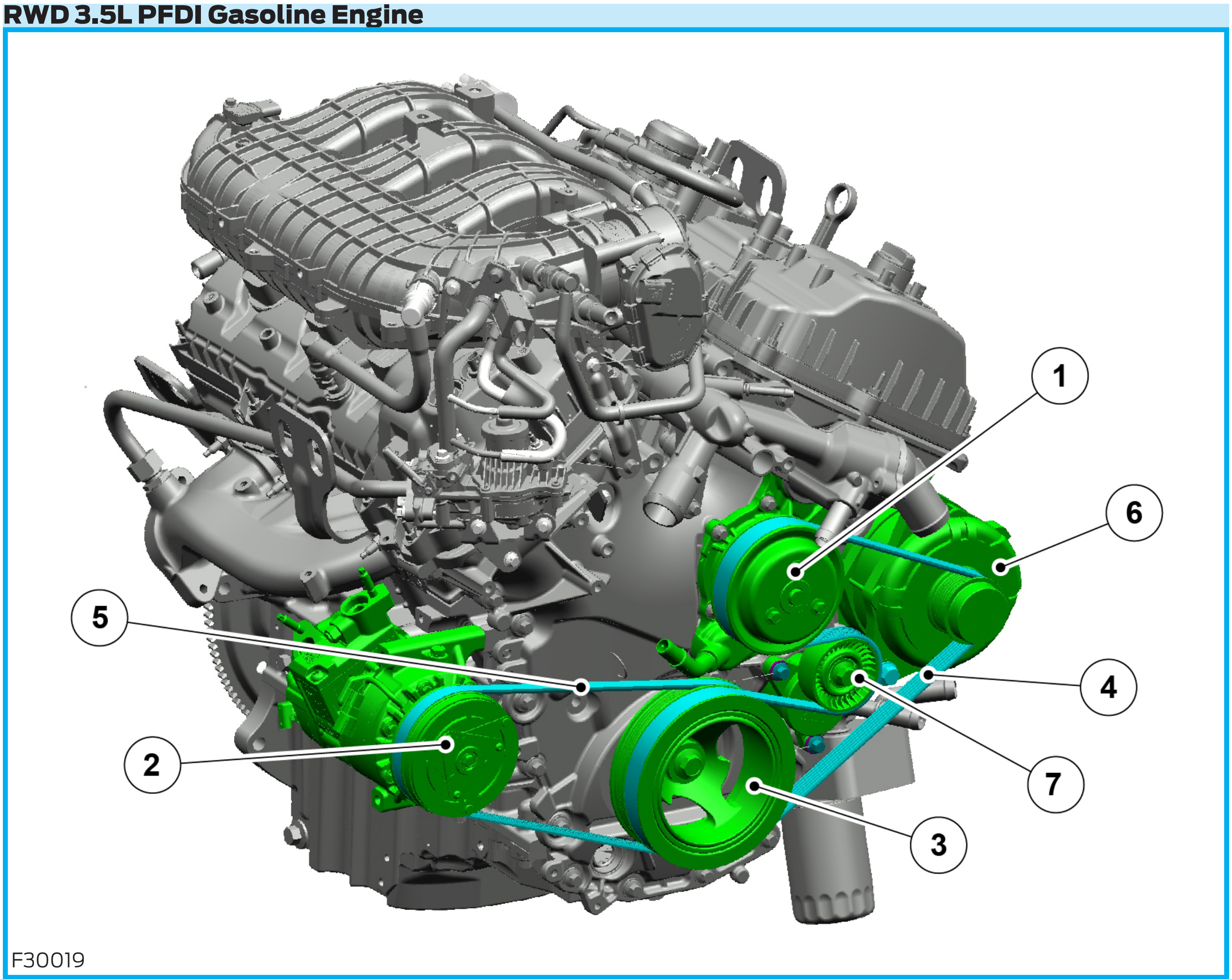
Make sure that the ancillary pulley diameter is less than the crankshaft pulley diameter.

If fitted, Front End Accessory Drive shields must be maintained at all times. If shields are removed, for example when attaching an ancillary unit, they must be replaced so that it is protected appropriately.

NOTE: No devices can be taken off the crank damper as this is a tuned device for system resonance.

The Eigen frequency of the bracket with auxiliary unit should be above the maximum excitation frequency of the main excitation order of the individual engine at engine top speed. On V6 cylinder engines this is the third engine order.

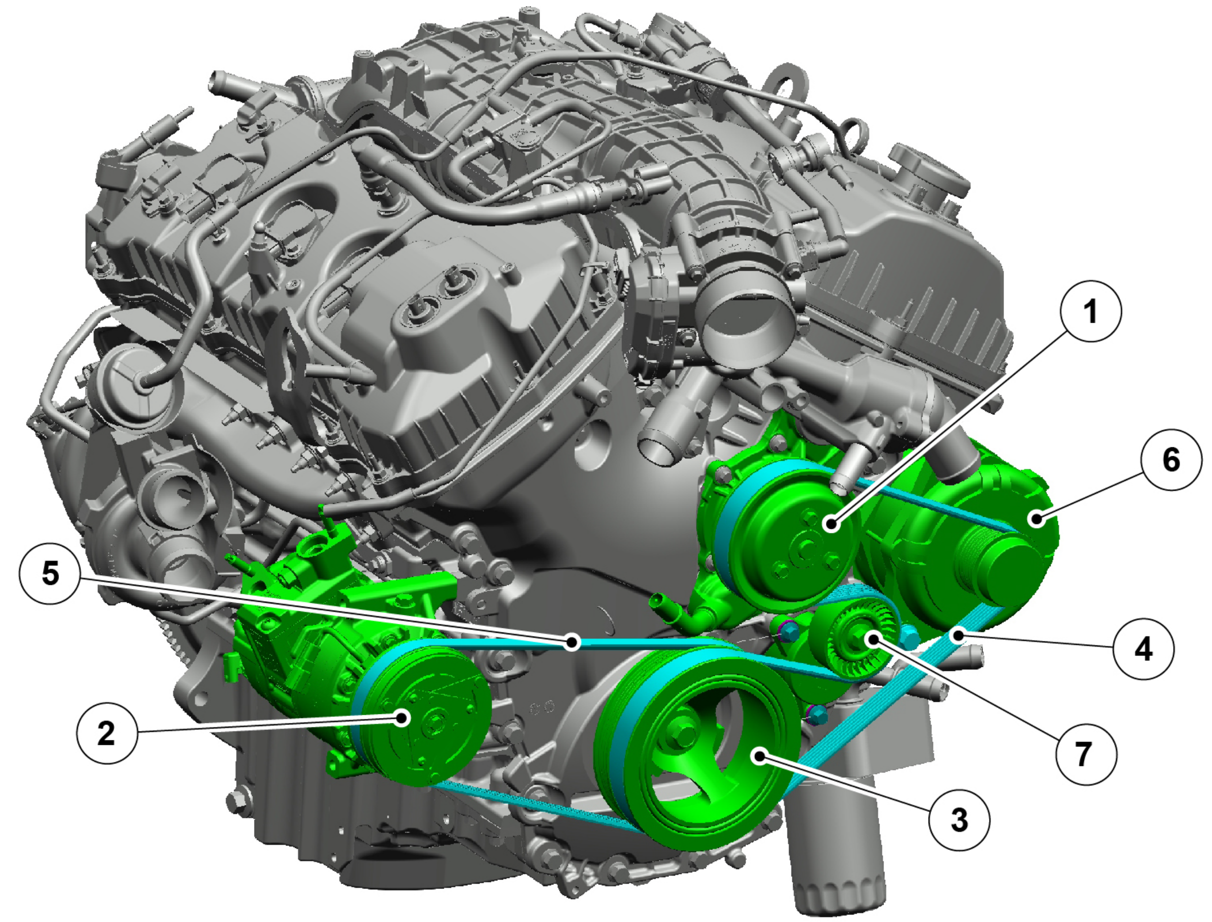
RWD 3.5L PFDI Gasoline Engine



Item	Description
1	Water Pump
2	AC Compressor
3	Crankshaft Pulley
4	Primary FEAD Belt
5	Secondary FEAD Belt
6	Alternator
7	Tensioner

🟩 Abc = BEV Only 🟦 Abc = ICE Only

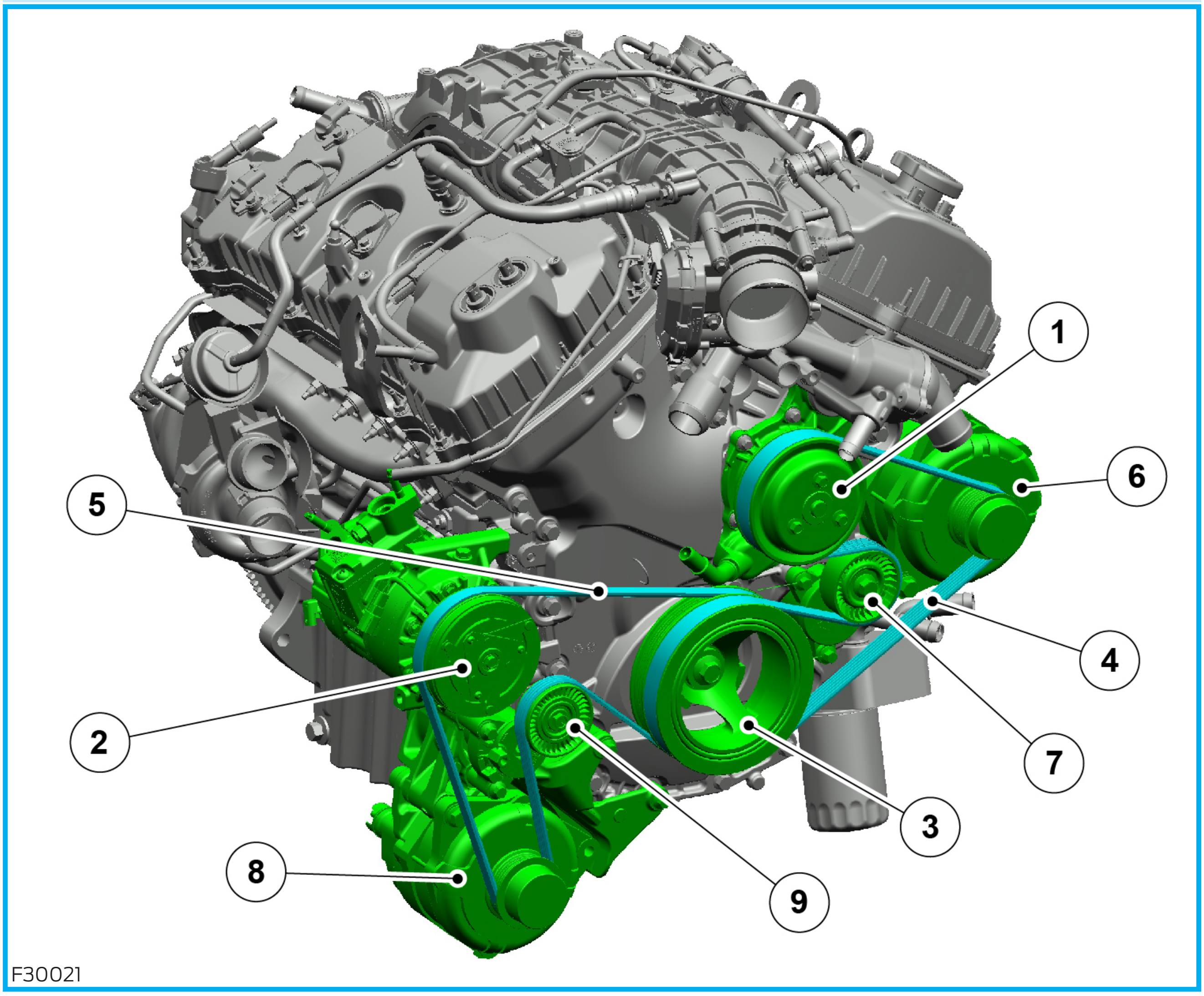
RWD 3.5L EcoBoost Gasoline Engine



F30020

Item	Description
1	Water Pump
2	AC Compressor
3	Crankshaft Pulley
4	Primary FEAD Belt
5	Secondary FEAD Belt
6	Alternator
7	Tensioner

RWD 3.5L EcoBoost Gasoline Engine - Dual Alternator



Item	Description
1	Water Pump
2	AC Compressor
3	Crankshaft Pulley
4	Primary FEAD Belt
5	Secondary FEAD Belt
6	Alternator
7	Tensioner
8	Alternator 2
9	Tensioner 2

3.4 Automatic Transmission, Transfer Case and Transfer Unit

WARNINGS:

⚠ **Do not reroute external transmission gear shift cables.**

⚠ **Do not change external electrical connectors.**

10R80 - 10 Speed Automatic Transmission

Gears	Base Transmission Ratio	Overall Transmission Ratio		
		Final Drive 3.31	Final Drive 3.73	Final Drive 4.10
1st	4.696	15.544	17.516	19.252
2nd	2.985	9.880	11 .134	12.239
3 rd	2.146	7.103	8.005	8.799
4th	1.769	5.855	6.598	7.253
5th	1.520	5.031	5.670	6.232
6th	1.275	4.220	4.756	5.228
7th	1.000	3.310	3.730	4.100
8th	0.854	2.827	3.185	3.500
9th	0.689	2.281	2.570	2.826
10th	0.636	2.105	2.372	2.606
Reverse	4.866	16.106	18.150	19.951

3.5 Exhaust System

3.5.1 Extensions and Optional Exhausts

CAUTIONS:

Non-standard systems must be tested for engine back pressure and all legal compliance (noise and emissions).

Make sure that for any pipes that require bending, the radius of the bend is minimum 2.5 x tube diameter.

Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.

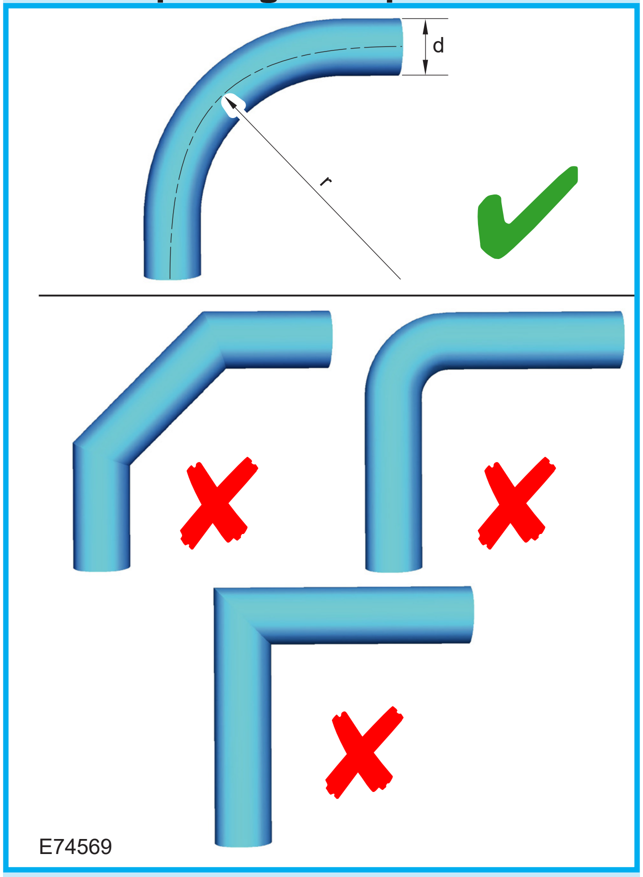
Repositioning of any of the emission devices, including emission substrates, sensors or actuators, will render the donor vehicle non-compliant from a legal/ emissions homologation point of view.

NOTE: Where possible all pipe connections should be designed so that the gas flows from smaller to larger diameter pipes.

When utilizing tailpipe extensions overloading the tailpipe hanger system must be avoided to ensure exhaust durability. If a ground out condition has been noted at the rear most tailpipe isolator an incremental hanger will be required. Align the exhaust so it meets Ford package recommendations. Use an exhaust isolator (CK41-5A262-A*) as a link between the exhaust and a body side hanger location.

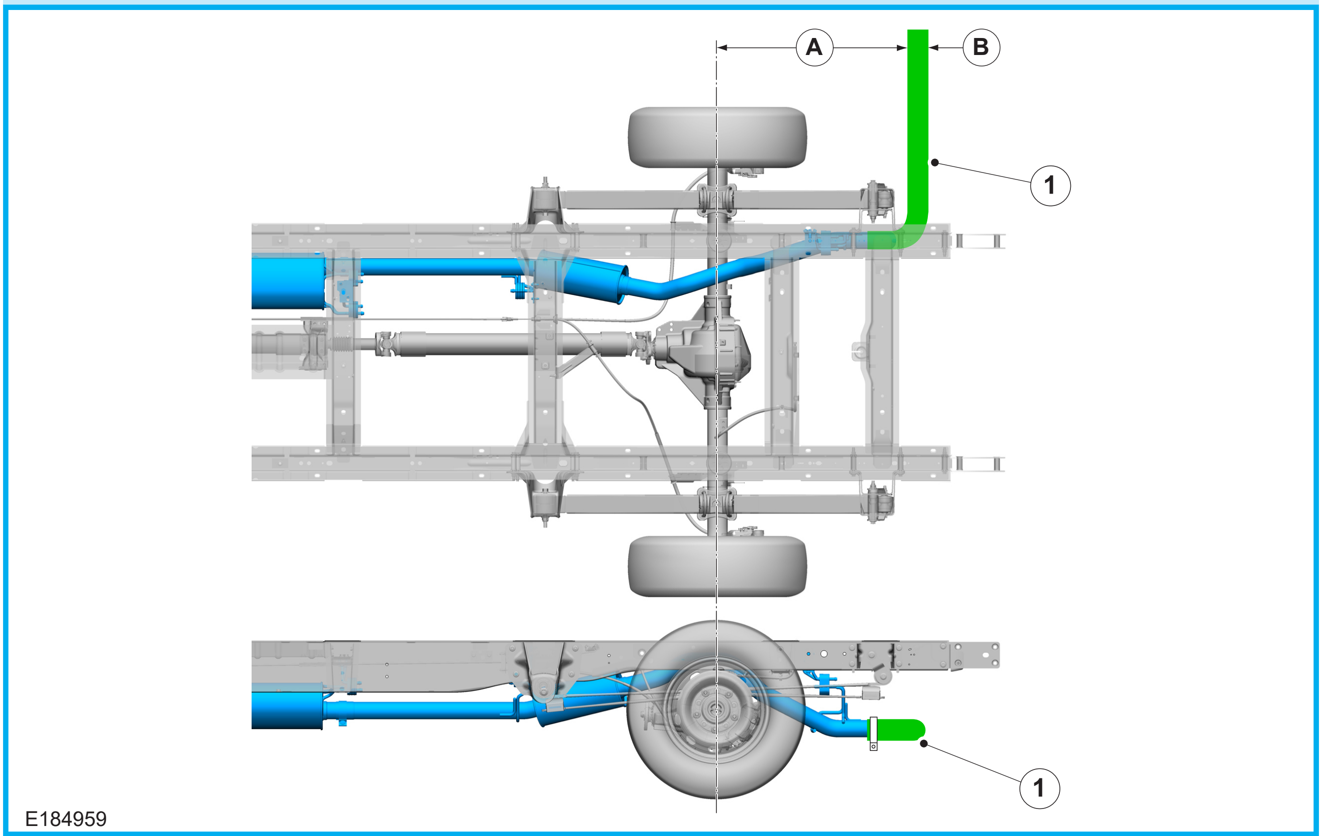
Extensions to the exhaust outlet pipe should direct exhaust way from the body to minimize the possibility of fumes entering the vehicle. Extensions should also protrude beyond the vertical body surface.

Exhaust Pipe Design Principles



Item	Description
d	diameter
r	radius => 2.5d

Gasoline Extended Exhaust - Chassis Cab/Cutaway



Item	Description
A	32.7” (830.6mm)
B	2.8” (70mm)
1	Extended Exhaust

NOTE: This procedure is to be performed by the vehicle modifier. The service procedure is provided with the Gasoline Exhaust Modification Kit (LK41-5K238-A*) which is included on all Chassis Cab and Cutaway vehicles. For further information please go to the Body Builders Advisory Service, https://fordbbas.com, or emailbbasqa@ford.com

- Air entrainment position should remain in the system (primary tailpipe)
- Only the pipe section aft of the primary air entrainment can be modified
- The length from the primary air entrainment to tailpipe end can be increased in length but not decreased
- The tip cannot be removed nor altered
- Modification must not change back pressure (neither increase nor decrease)
- Appropriate heat shielding must be added if required

3.5.2 Exhaust Pipes and Supports

CAUTIONS:

Maintain the original set-up and heat shields.

Do not position any components closer than 5.9” (150mm) nominal, 3.9” (100mm) minimum clearance to the downpipe, the catalytic converter and any part of the exhaust system.

3.5.3 Exhaust Heat Shields

CAUTION: Standard heat shields are available from your local dealer and can easily be fitted. Additional heat shields may be required over the modified exhaust system, particularly in areas of close proximity to the floor.

Catalytic converters, in particular, operate at high temperatures. Ensure existing shields are maintained. Add further shields over exhaust system as necessary to avoid fire risk

3.5.4 Cutaway Exhaust Systems

To avoid exhaust gas ingress into the vehicle the gap in the floor between the B-pillar will require a spacer plate (not supplied). For additional information refer to:
5.1.9 Cutaways Cutaway Floor Spacer
5.1 Body

For further information please go to the Body Builders Advisory Service, https://fordbbas.com, or email bbasqa@ford.com

3.6 Fuel System

3.6.1 3.5L PFDI and 3.5L EcoBoost Gasoline Fuel System

WARNINGS:

⚠ **Do not cut into the original fuel supply lines.**

⚠ **Make sure that the modified vehicle complies with all relevant legal requirements.**

3.6.2 25 Gallon (95L) Fuel Tank

NOTE: A 90º connector can be ordered as a service item, part number CK41-9B210-A*. The auxiliary fuel line is not offered as a serviceable item.

For vehicles without auxiliary fuel line that require a fuel supply for applications (for example: auxiliary heater) it is advisable to use the auxiliary fuel supply port on the top of the fuel sender unit located on the top of the fuel tank as shown in figure E185264

NOTE: To fit the auxiliary fuel line, the fuel tank will need to be lowered, see following process:

To lower fuel tank:

- Drain tank
- Remove filler pipe from tank
- Remove bolts securing the three tank straps (four tank straps on extendend range fuel tank option)
- Lower the fuel tank to gain access to the top, see Figure E185264 for fitting auxiliary fuel line To refit fuel tank:
- Lift fuel tank ensuring not to trap fuel lines and electrical wires
- Refit straps, torque bolts to 47.5Nm ± 7.2Nm
- Refit filler pipe to tank spud securing hose clip torque to 3.7Nm ± 0.6Nm

CAUTION: Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.

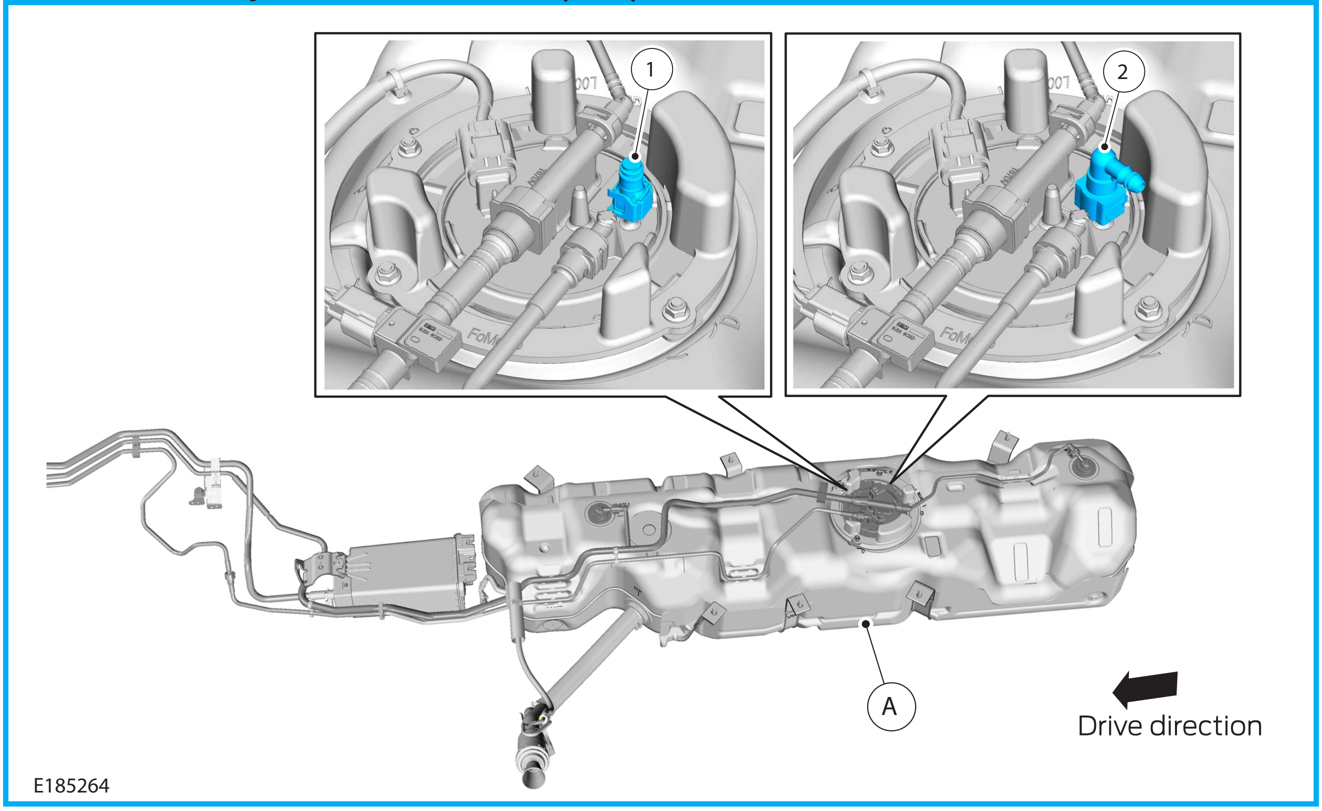
NOTE: Remove protective cap from auxiliary port on top of FDM and assemble connector.

NOTE: The tube and/or line must be routed independently and secured to the body structure or to suitable brackets.

NOTE: Ensure that a suitable fuel shut-off is fitted in any unique system.

NOTE: Do not fasten anything to existing electrical components, wires or fuel lines.

Gasoline Auxiliary Fuel Port: 25 Gallon (95L) Tank



E185264

Item	Description
A	Gasoline Fuel Tank
1	Protective cap - To remove: slide the plastic tab, squeeze the cap and pull off to expose the gasoline fuel port. Assemble quick fit 90º connector.
2	A 90º connector is required. Gasoline Aux Port kit part number CK41-9B210-A*

3.6.3 31 Gallon (115L) Fuel Tank

Auxiliary Fuel Extension Line Option for Extended Range Fuel Tank.

This option allows commercial vehicle upfitters to add an additional fuel line to the Transit fuel tank (31 Gallons/115L only) to power installed equipment such as generators, without having to remove and reinstall the fuel tank assembly. An additional fuel line can be attached to the Auxiliary Fuel Extension using the Female 5/16” Gen 3 Quick Connect fitting at the lower end. A Male 5/16” Gen 3 Quick Connect fitting will be required to mate with the fitted Female fitting.

CAUTION: Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.

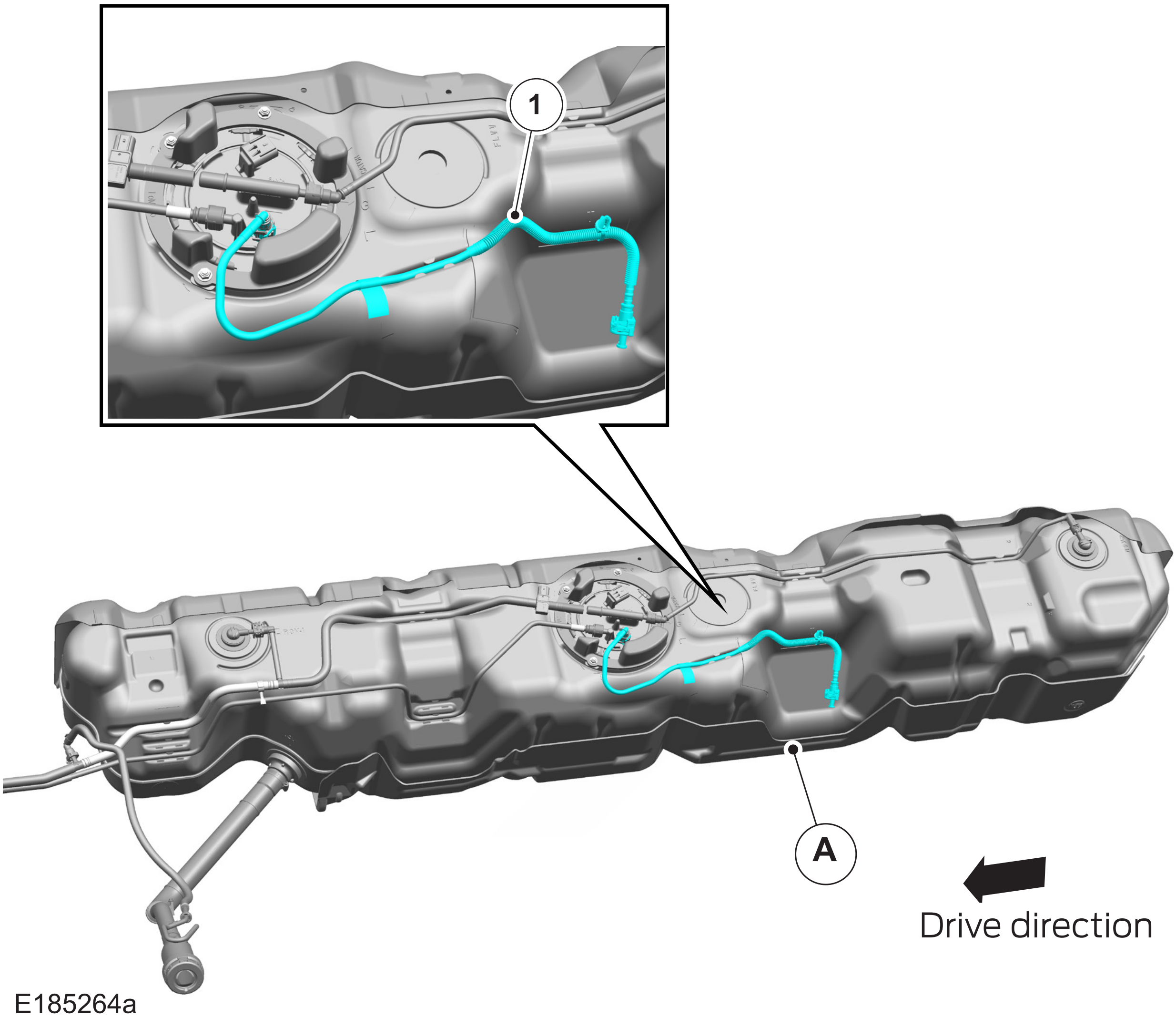
NOTE: Any addidtional fuel lines must be routed independently and secured to the body structure or to suitable brackets.

NOTE: Ensure that a suitable fuel shut-off is fitted in any unique system.

NOTE: Do not fasten anything to existing electrical components, wires or fuel lines.

Additionally, refer to:
5.1.4 Floor Precautionary Drill Zones

Gasoline Auxiliary Fuel Extension Line: 31 Gallon (115L) Tank



Item	Description
A	Gasoline Fuel Tank
1	Auxiliary Fuel Extension Line

3.7 High Voltage System & Electrified Drivetrain

WARNINGS: Before beginning any vehicle modifications refer to the following overview of High Voltage System Health & Safety Precautions

3.7.1 High Voltage Health & Safety Precautions

WARNINGS:

Do not touch, drill, modify or obscure the orange High Voltage cables, fasteners, channels, strain relief, ground wire or connectors

Service of the High Voltage system on this vehicle is restricted to qualified personnel. The required qualifications vary by region. Always observe local laws and legislative directives regarding electric vehicle service. Failure to follow this instruction may result in serious personal injury or death.

To prevent the risk of High Voltage shock, always follow precisely all warnings and service instructions, including instructions to de-energize the system. The High Voltage system utilizes approximately 450V DC, provided through High Voltage cables to its components and modules. The High Voltage cables and wiring are identified by orange harness tape or orange wire covering. All High Voltage components are marked with 'High Voltage' warning labels with a 'High Voltage' symbol. Failure to follow these instructions may result in serious personal injury or death

Any work on the High Voltage system requires the Low Voltage Service Disconnect to be open and locked out. Failure to follow these instructions may result in serious personal injury or death.

Extreme heat, such as paint drying ovens, will cause the damage to the High Voltage battery. The High Voltage battery must be removed before using paint drying ovens longer than 45 minutes or with temperatures above 60ºC (140ºF). Failure to follow this instruction may result in damage to the high voltage battery, which could cause serious personal injury or death in a fire or explosion. Please refer to the Ford E-Transit workshop manual.

De-energizing the High Voltage system does not dissipate the voltage inside the High Voltage battery. The battery pack remains live and dangerous. Contact with the High Voltage battery pack internals may result in serious personal injury or death

Powertrain software calibrations must not be modified (this includes Electric Vehicle Control Module, Primary Drive Control Module, Battery Charge Control Module Battery Energy Control Module and Antilock Braking System Control Module).

Direct contact with high voltage components by personnel, tools or equipment should generally be avoided, including stepping on or leaning on them, setting tools on them, etc

"High Voltage" is defined in Federal Motor Vehicle Safety Standard 305 as:

- Greater than 60 volts for Direct Current (DC) circuits.
- Greater than 30 volts RMS for Alternating Current (AC) circuits.

Subsequent stage manufacturers and vehicle alterers should NOT plan to connect with or modify the high voltage system or components in any way. Integration with the vehicle electrical system must be done only with the low voltage (12 volt) electrical system, or with outlet(s) provided with the "Pro Power Onboard" feature (where applicable)

Only qualified Ford service personnel should attempt to diagnose or repair any high voltage components or systems. Any personnel involved in engineering, subsequent stage manufacturing, modifying, or servicing vehicles with high voltage systems (content other than the HV systems) should be trained in basic understanding and safety principles regarding HV systems.

Emergency Response Guides – Information for First Responders may be helpful in developing an emergency response plan in case a vehicle with a HV system is damaged.

The following manufacturing operations are not recommended on vehicles with High Voltage systems:

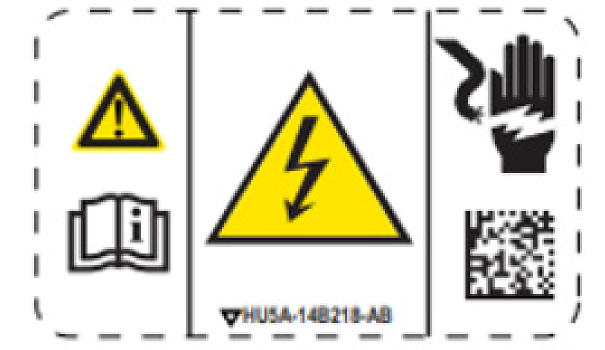
- Operations generating significant heat near HV components, especially near the HV battery.
- Paint curing operations above 60ºC (140ºF) or longer than 45 minutes.

For welding/drilling or cutting, refer to sections:
5.1.5 No Drill/No Weld Zones - BEV
5.1.6 BEV Van Floor Drilling

High Voltage Labels

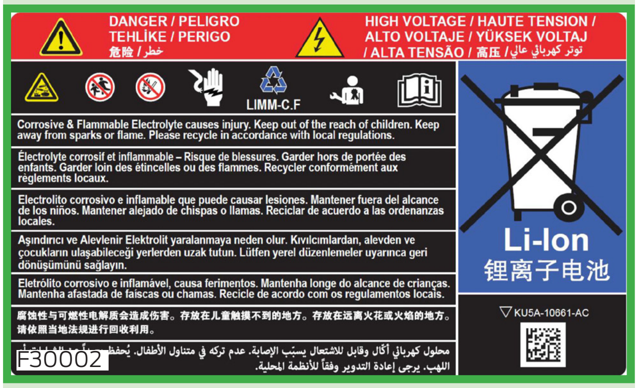
On electric vehicles, ‘WARNING’ labels are located on High Voltage componenents throughout the vehicle as per the following examples. High Voltage warning symbols are not to be obscured or altered in any way:

HV Label Example 1



F30001

HV Label Example 2


DANGER / PELIGRO
TEHLİKE / PERIGO
危险 / خطر

HIGH VOLTAGE / HAUTE TENSION /
ALTO VOLTAJE / YÜKSEK VOLTAJ
/ ALTA TENSÃO / 高压 / توتر كهربائي عالي

LIMM-C.F

Corrosive & Flammable Electrolyte causes injury. Keep out of the reach of children. Keep away from sparks or flame. Please recycle in accordance with local regulations.

Électrolyte corrosif et inflammable – Risque de blessures. Garder hors de portée des enfants. Garder loin des étincelles ou des flammes. Recycler conformément aux règlements locaux.

Electrolito corrosivo e inflamable que puede causar lesiones. Mantener fuera del alcance de los niños. Mantener alejado de chispas o llamas. Reciclar de acuerdo a las ordenanzas locales.

Aşındırıcı ve Alevlenir Elektrolit yaralanmaya neden olur. Kıvılcımlardan, alevden ve çocukların ulaşabileceği yerlerden uzak tutun. Lütfen yerel düzenlemeler uyarınca geri dönüşümünü sağlayın.

Eletrólito corrosivo e inflamável, causa ferimentos. Mantenha longe do alcance de crianças. Mantenha afastada de faíscas ou chamas. Recicle de acordo com os regulamentos locais.

腐蚀性与可燃性电解质会造成伤害。存放在儿童触摸不到的地方。存放在远离火花或火焰的地方。请依照当地法规进行回收利用。

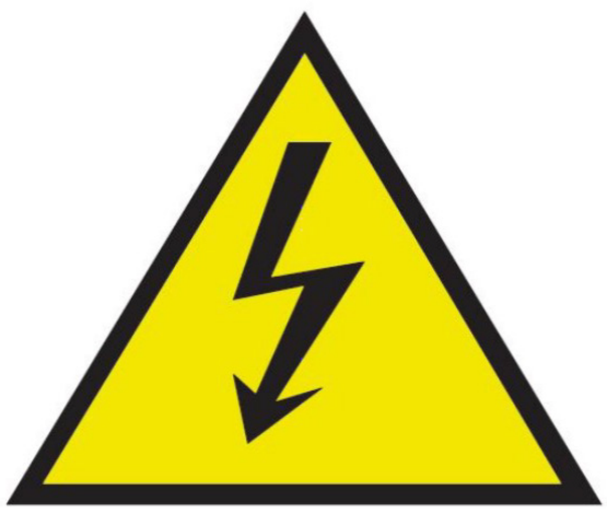
محلول كهربائي أكّال وقابل للاشتعال يسبّب الإصابة. عدم تركه في متناول الأطفال. يُحفظ
اللهب. يرجى إعادة التدوير وفقاً للأنظمة المحلية.

Li-Ion
锂离子电池

▽KU5A-10661-AC

F30002

HV Label Example 3f

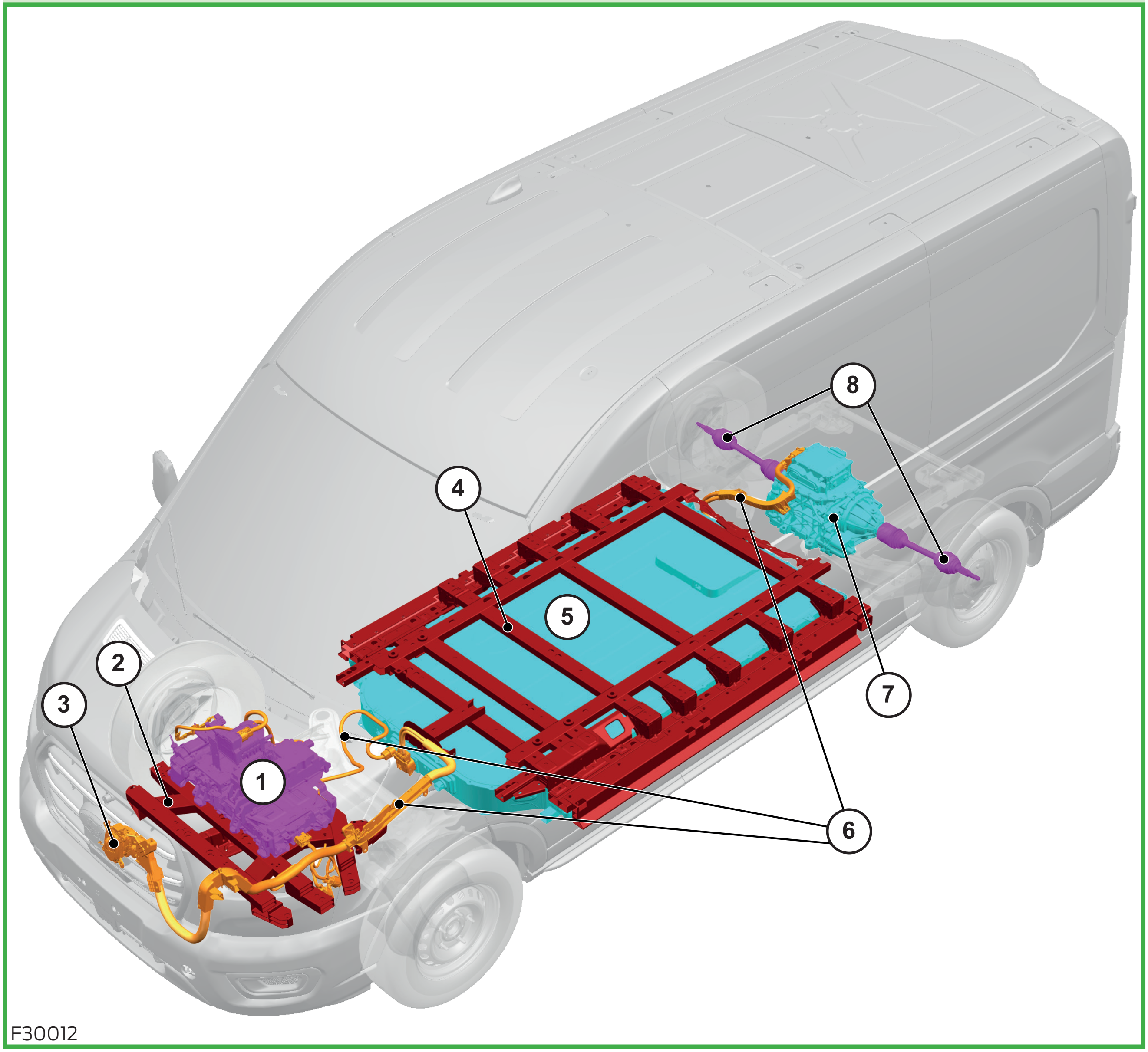


F30003

3.7.2 High Voltage System Overview

The High Voltage System on E-Transit consists of a centrally mounted, underfloor High Voltage Battery Pack, a front-mounted 'stack' of HV control systems under the 'hood', that are mounted to the 'Megabrace' and an Electric Drive Assembly providing drive to the rear wheels. These are connected by orange High Voltage cables and a system for cooling the components of the High Voltage system

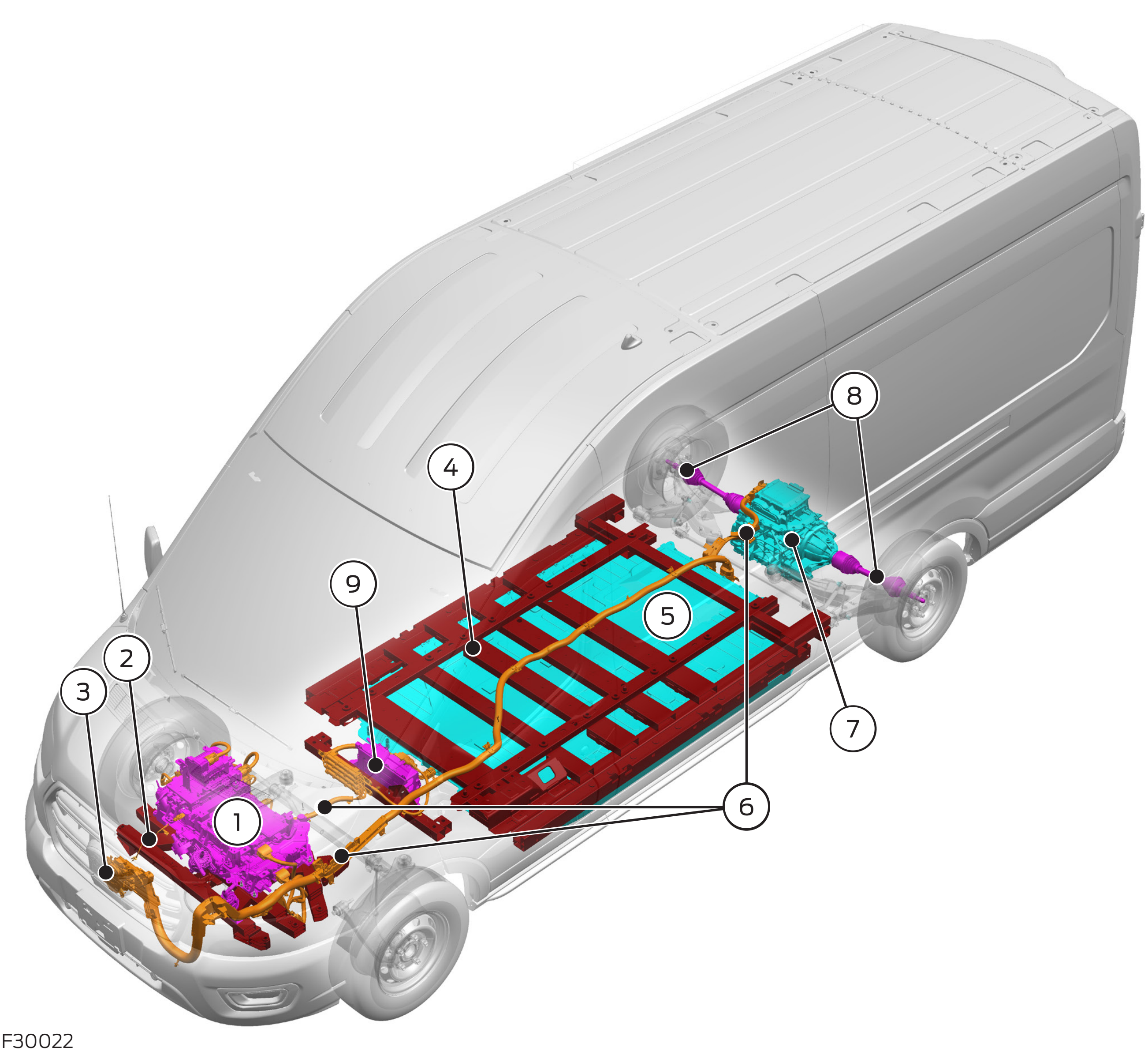
High Voltage System Overview - Standard Range Battery



F30012

Item	Description
1	High Voltage Module Stack
2	Megabrace
3	High Voltage Charge Port Inlet
4	High Voltage Battery Cradle
5	High Voltage Battery Pack
6	Orange High Voltage Cables
7	Electric Drive Assembly
8	Halfshafts

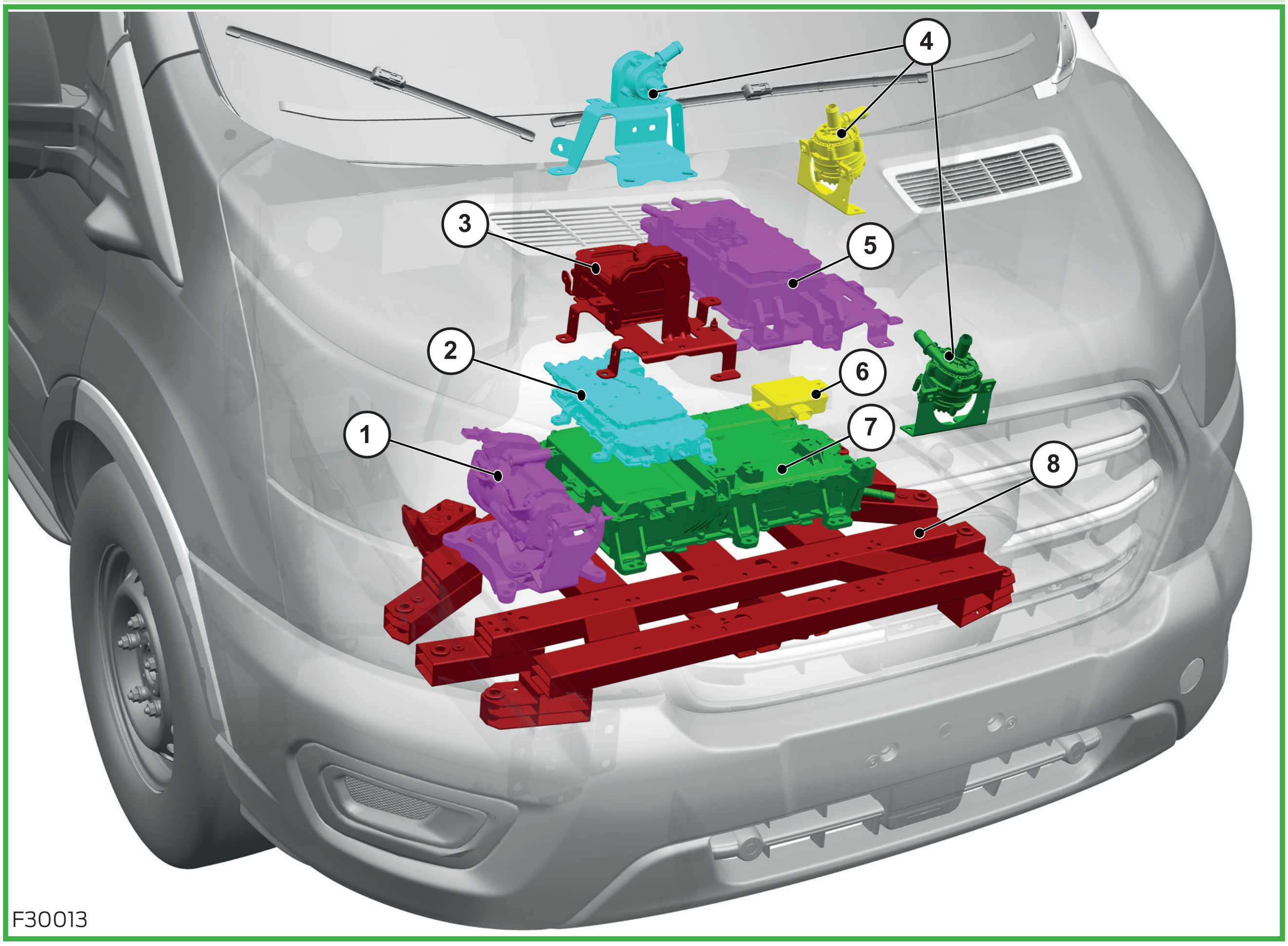
High Voltage System Overview - Enhanced Range Battery



Item	Description
1	High Voltage Module Stack
2	Megabrace
3	High Voltage Charge Port Inlet
4	High Voltage Battery Cradle
5	High Voltage Battery Pack
6	Orange High Voltage Cables
7	Electric Drive Assembly
8	Halfshafts
9	On Board Generator Inverter

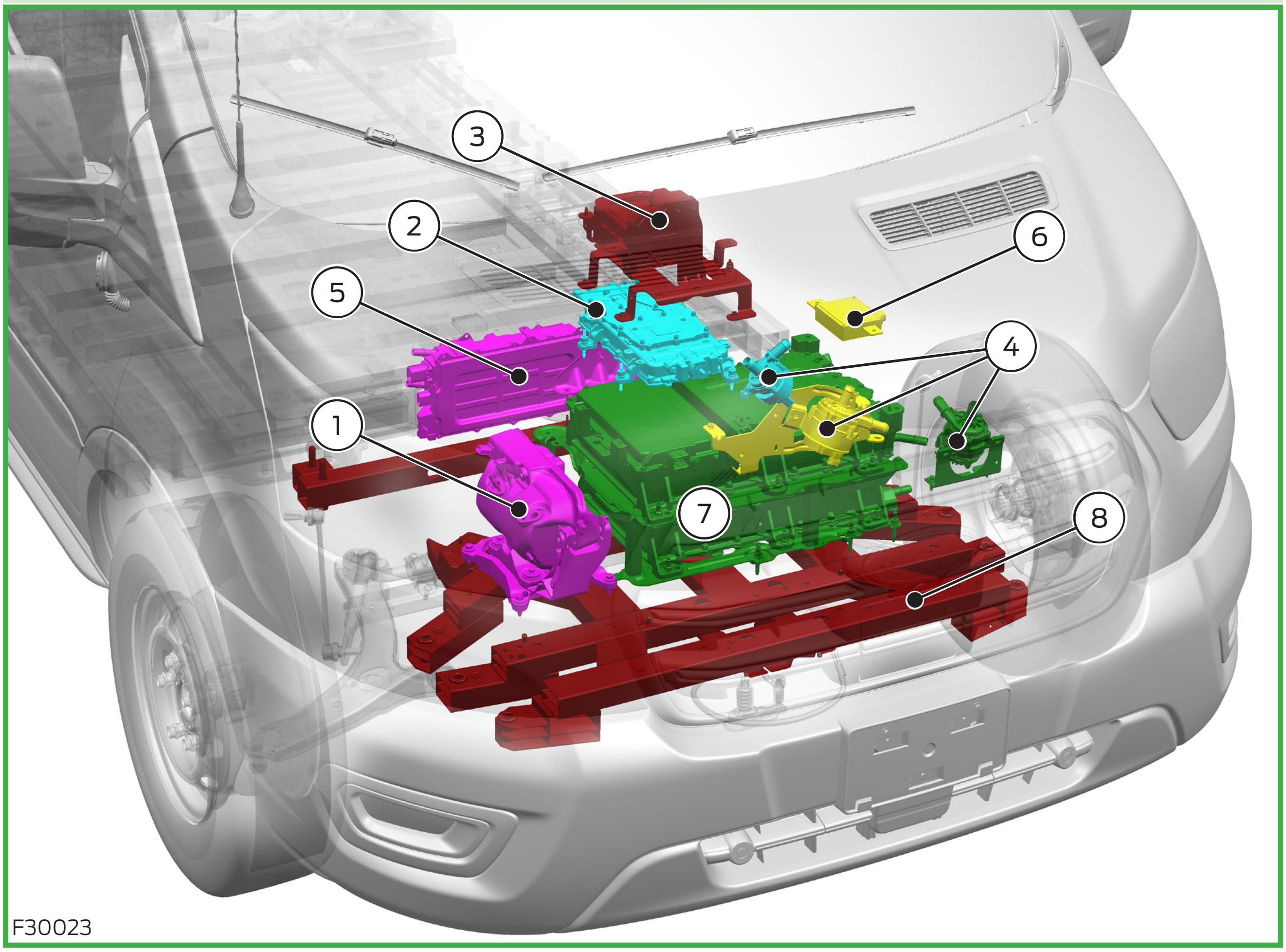
🟩 Abc = BEV Only 🟦 Abc = ICE Only

Exploded View of HV Stack Components - Standard Range Battery



Item	Description
1	Electric Air Conditioning Compressor
2	DC-DC Converter
3	Electric Heater
4	Cooling Pumps and Valves
5	On Board Generator Inverter (OBGI) Module (optional)
6	Off Board Charger Control (OBCC) Module
7	Charge Unit
8	Megabrace

Exploded View of HV Stack Components - Enhanced Range Battery



Item	Description
1	Electric Air Conditioning Compressor
2	DC-DC Converter
3	Electric Heater
4	Cooling Pumps and Valves
5	On Board Generator Inverter (OBGI) Module (optional)
6	Off Board Charger Control (OBCC) Module
7	Charge Units
8	Megabrace

3.7.3 HV System De-Energizing

Please refer to the Ford E-Transit workshop manual for de-energizing procedure.

WARNING: De-energizing the High Voltage system does not dissipate the voltage inside the High Voltage battery. The battery pack remains live and dangerous. Contact with the High Voltage battery pack internals may result in serious personal injury or death

NOTE: When the HV system has been de-energized, the 12V Low Voltage system will remain live

3.7.4 HV Cooling System

It is recommended that when installing an auxiliary heater and/or air conditioning system the Final Stage Manufacturer meet or exceed the occupant comfort heating and cooling performance of the current production vehicle..

CAUTION: The performance of the Ford defrost and defog system must not be diminished by the addition of an auxiliary heater and/or air conditioning system. Final Stage Manufacturers are reminded of their responsibility to maintain compliance to FMVSS 103 and CMVSS 103, Windshield Defrosting and Defogging Systems.

Ford Motor Company OEM Front System Specifications for E-Transit:

- Thermostatic Expansion Valve (TXV) size: 2.0 Ton
- AC Compressor Displacement: 34 cc Fixed
- AC Condenser Heat Rejection: Heating Mode - 2.6 kW, Cooling Mode - 10.3 kW
- R134a Refrigerant Charge: 31.7 oz (900g)
- POE Refrigerant Oil: 4.94 oz (140g)
- Coolant Heater: 5.0 kW

Auxiliary AC Requirements:

- No factory prep packages are available. Tie into the OEM system using custom lines that obtain refrigerant liquid between the receiver dryer and front TXV and return refrigerant to the suction line between the front TXV and the compressor.
- Do NOT use an auxiliary Cycling Clutch Orifice Tube (CCOT) system in combination with the OEM front TXV system.
- An auxiliary TXV with a refrigerant bleed is required. This will assist oil and refrigerant return to the AC Compressor under all conditions.
- It is the responsibility of the Final Stage Manufacturer when combining an auxiliary AC system with the OEM AC system to perform Refrigerant Charge Level Determination, Oil-in-Circulation and Evaporator Icing tests.
- Motorcraft R-1234yf Refrigerant POE oil (WSS-M2C31-B2 / YN-34) must be used as the refrigerant system lubricant. Addition of any other oil risks damage to the AC compressor and contaminates the refrigerant system.
- It is the responsibility of the Final Stage Manufacturer to maintain a 4% suspended oil ratio in the AC system for proper compressor lubrication.
- A label stating the revised total refrigerant charge, type of refrigerant (R134a), total oil charge and type of compressor lubricating oil (POE), must be affixed in a conspicuous place in the engine compartment.
- Compressor discharge gas temperature should not exceed 130°C skin temperature when measured under any conditions. Skin temperature should be measured on the AC discharge line immediately out of the compressor.
- Final Stage Manufacturers are reminded of their responsibility to maintain compliance to CARB and EPA requirements related to AC Greenhouse Gas Regulations.
- AC systems with Electric Compressors should use barrier or veneer type A/C hose, SAE J3062 Hose Type Cu or EU. Joint or connection types (serviceable fittings) should be Seal Washer, Dual Seal Washer, Seal Washer with O-ring, or Metal Seal Fitting (Metal Gasket) as shown in SAE J2727.
- At no time should the cooling fan shroud or cooling fans be modified.
- Do not modify any of the front-end seals to the cooling module. These prevent hot air recirculation from coming back into the AC Condenser
- Do not splice into any compressor wire harness.

Auxiliary Heater Requirements

- Tying into the OEM Heating and Defrost coolant system will result in the sharing of heated coolant produced by a single high voltage coolant heater across the production front HVAC heater core and the auxiliary HVAC heater core. This may result in lower than desired discharge air temperatures and undesired heater performance.
- Use only the coolant type specified in the vehicle owner's manual

AC and Heater Line Routings

- Final Stage Manufacturer may want to consider adding manual bleed devices/ports in high points of the coolant system to assist with purging air out of the system during the coolant fill process.
- Routing clips or other aids should be used to keep components from rubbing or chaffing.
- Use only metallic "Y" and "T" type coolant fittings or OEM approved materials.
- Do not route lines/hoses in the wheelhouse area.
- Do not route lines/hoses near sharp edges or moving component parts. There must be shield protection from any potential abrasive sources.
- Do not route refrigerant or coolant lines below the ground clearance zone.
- When routing in stone kick-up area, lines should be protected by shielding.
- Minimize the use of concentric protective heater hose shields. Limit length of concentric hose shields to 305 mm [12 in] maximum.
- Consider encasing added suction lines in insulating foam from connector location under body to the secondary evaporator for improved performance.
- AC and Heater Line Routings (continued)
- To prevent liquid accumulation in the rear of the vehicle, a "candy cane" style connection is recommended on the Final Stage Manufacturers' AC lines that tie into the OEM system. Recommended minimum height is 100 mm and no more than 10 degrees from vertical. See Fig 1 overleaf.

Battery Heating and Cooling

- The large traction battery on this vehicle is cooled by the chiller and otherwise surface convection. There is no low temperature radiator (LTR). The chiller is an evaporator connected to the AC system that produces cold coolant, instead of cold air, to cool the battery.
- The battery is heated with the same heater used for the cabin, although battery heating only occurs when the vehicle is connected to a charger.
- Vehicle performance effects due to battery

Liquid/Suction Line Example

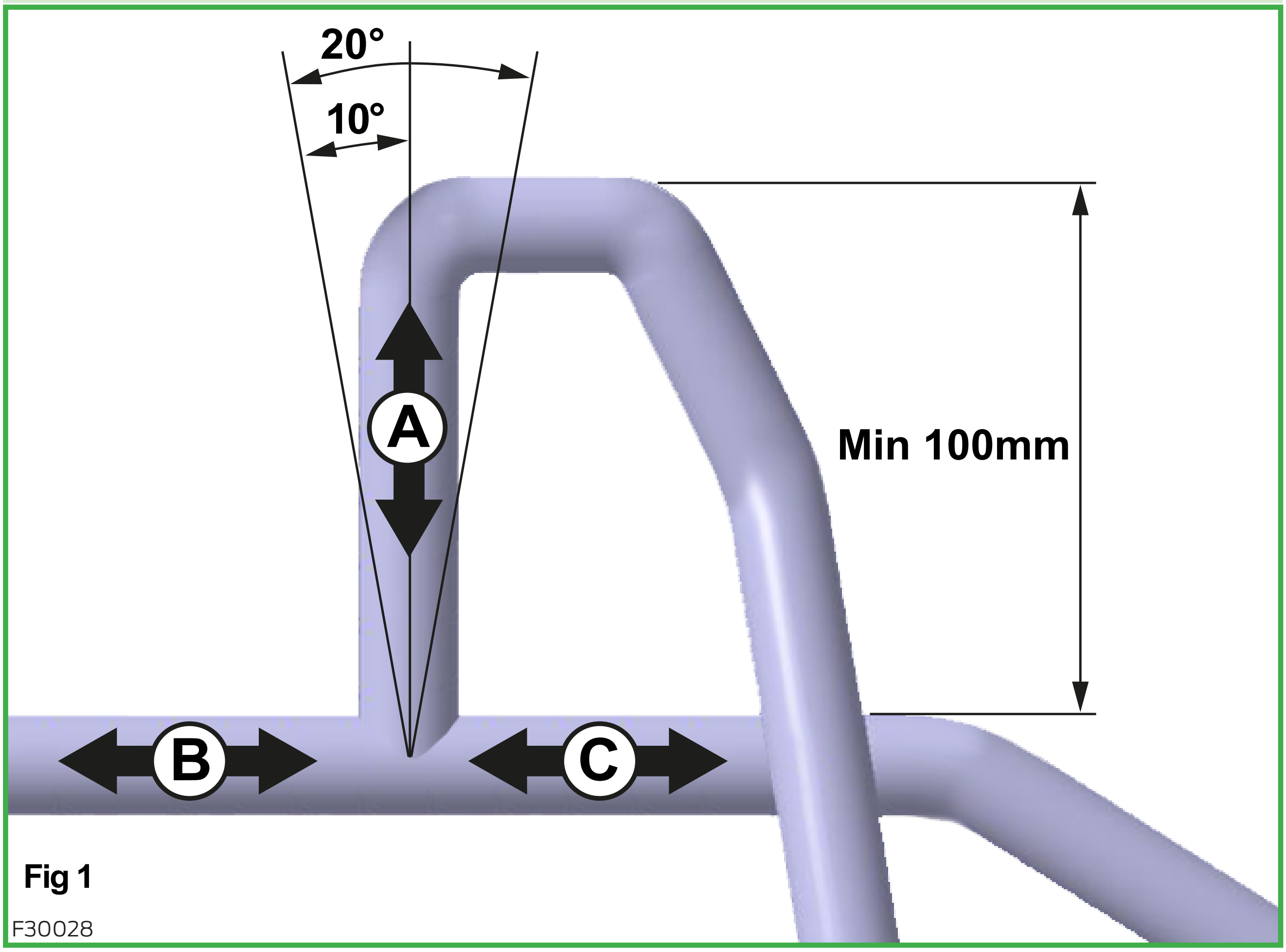


Fig 1

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Item	Description
A	To/From Aux. Evap.
B	To/From Front Evap.
C	From Condensor/To Compressor

thermal derate can occur, if the battery thermal system (heat, cool) is impacted, making the battery too hot or too cold for proper performance.

Other/Miscellaneous

- Ideally, auxiliary Heater outlets should be located lower in vehicle, near the floor and auxiliary AC outlets should be located higher in the vehicle, near or in the headliner
- Keeping the vehicle plugged into a level 2 charger when not in use will enable battery conditioning (charging, heating, cooling) and cabin pre-heating or cooling. This will assist in maximizing available battery power during vehicle usage.
- E-Transit is available with an optional 2.4 kW Pro Power Onboard feature. Final Stage Manufacturers may want to consider usage of this feature for supplemental heater and cooling purposes
- Final Stage Manufactures should consider modifications such as solar glass and lightweight insulation to reduce the overall thermal load on the vehicle, thereby, maximizing the battery power available for vehicle usage.

3.7.5 Electric Drive Assembly

CAUTIONS:

For E-Transit BEV, do not modify the Electric Drive Assembly

For E-Transit BEV, do not modify the Halfshafts in the Electric Drive Assembly

3.7.6 High Voltage Battery

Observe the following precautions when working on or around High Voltage Batteries

- Do not cut the High Voltage Battery case. Do not penetrate the batteries or case in any way.
- The High Voltage Battery Pack is located under the vehicle.
- The total voltage of the HV Battery Pack may be up to approximately 450V DC.
- The Battery Case is water resistant.
- The battery cells contain liquid electrolyte absorbed in a porous special polymeric film. The electrolyte will not leak from the battery under most conditions. However, if the battery is crushed,

it is possible for a small amount of electrolyte to leak.

- If possible, isolate and avoid contact with any electric vehicle components. If contact with the High Voltage system cannot be avoided, Personal Protective Equipment (PPE) such as a splash shield or safety goggles, gloves (butyl), an apron or overcoat and rubber boots are required when handling damaged batteries. Exposure to electrolyte could cause skin and/or eye irritation/burns. If exposed, rinse with large amounts of water for 10-15 minutes.

The high voltage system has a floating return reference, which is designed to completely isolate the HV system from the vehicle chassis and non-HV components and circuits. As part of the safety features built in to the HV system, measurements between the HV bus and vehicle ground are monitored during key “on” state to detect high voltage leakage or stray current to the chassis.

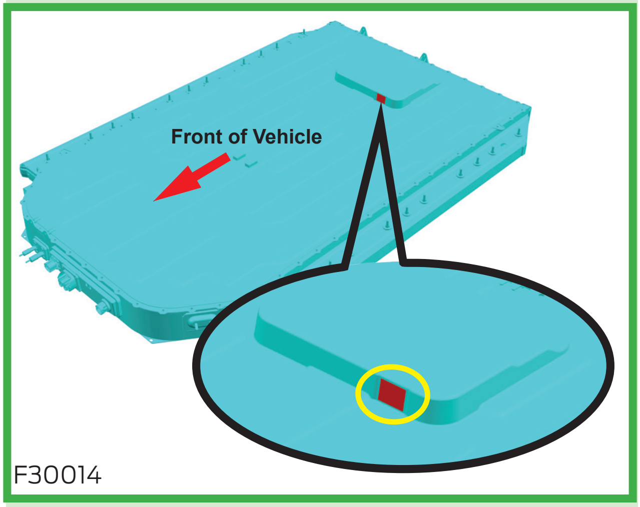
The power terminals of the high voltage battery are only activated when necessary for vehicle operation, including:

- When the vehicle is in key “on” or “accessory” state.
- When the 12v battery has a low state of charge - the HV battery will activate to charge the 12v battery through the DC-to-DC Converter, even in the vehicle key “off” state
- When the vehicle is plugged into a charging station (BEV only) - the charge port, charge unit, HV battery and wiring between these components may be active, with high voltage present even in the vehicle key “off” state.

HV Battery Venting

1. The E-Transit BEV HV Battery is equipped with an exhaust vent. No additional components nor obstructions (beyond any installed by Ford) shall be located in the same environment as the battery (e.g., underbody) and within 150 mm of these features. Additionally, no components which may contain combustible liquids or gases at any time shall be added within 300 mm of these features.
2. There shall be no modifications or installed components which confine the air space near the outside of the HV Battery or obstruct the free flow of air about the battery (beyond any installed by Ford).
3. Any cut outs or openings created between the occupant space and the vehicle underbody shall be sealed such that air is not free to pass from under the vehicle into the occupant space.
4. If any primary ingress/egress paths for occupant spaces are located above or rearward of the rear axle(s), a metallic shielding shall be added to obstruct any air flow from the battery towards those ingress/egress paths, and redirect that air flow towards a side/rear area that is not a primary ingress/egress path.

HV Battery Vent - Standard Range Battery



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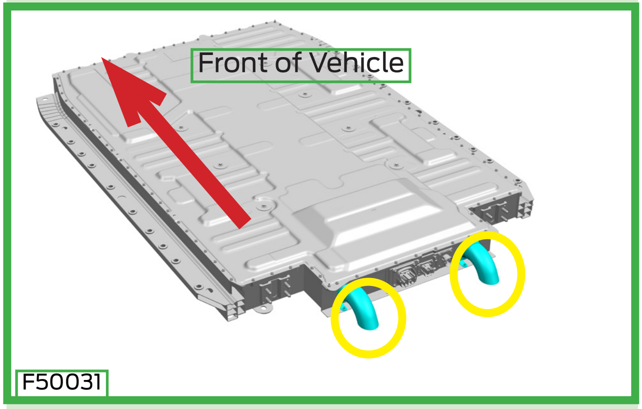
HV Battery Vent - Enhanced Range Battery



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HV Battery Grounding

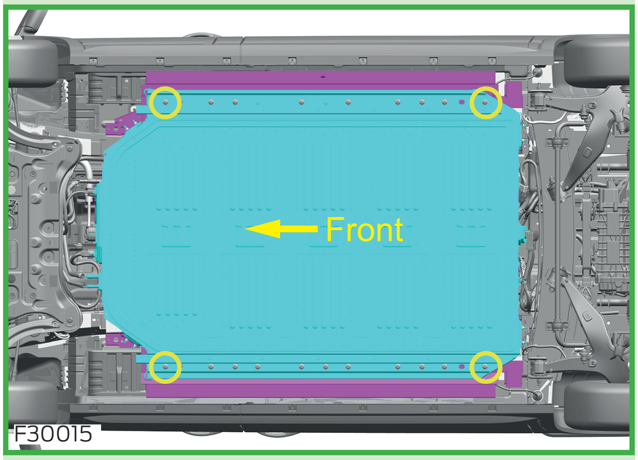
WARNINGS:

⚠ **The following illustrations indicate the points where the High Voltage Battery and Cradle are grounded. These points should NOT be used as additional/auxiliary grounding points for the Low Voltage (12V) system.**

⚠ **Electrical ground paths (case grounds and/or ground straps and/or low voltage wiring) for High Voltage components on the E-Transit BEV must not be altered or modified in any way. Do not tamper with or modify any of these HV component fastener joints or ground points**

NOTE: As part of the safety features built in to the HV system, measurements between the HV circuitry and vehicle ground are measured using these ground paths. Therefore, HV battery ground paths must not be altered in any way.

HV Battery to Cradle Grounding Fasteners: Van and Chassis Cab - Standard Range Battery



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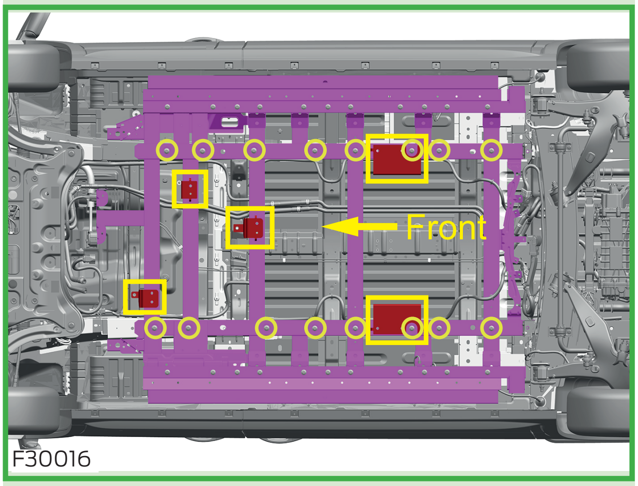
HV Cradle to Chassis Grounding Fasteners and Grounding Brackets: Van - Standard Range Battery



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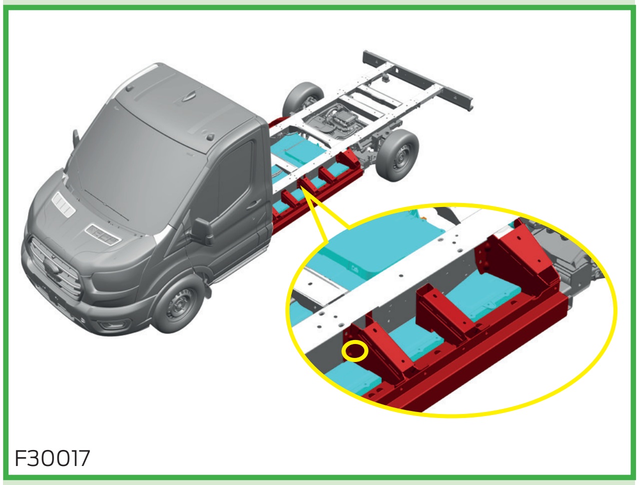
NOTE: Battery ground path for Van and Chassis Cab/Cutaway are not the same, the complete battery ground path includes the cradle as well as attachment to the body rail.

HV Battery Grounding Location - Cradle to Chassis: Chassis Cab - Standard Range Battery



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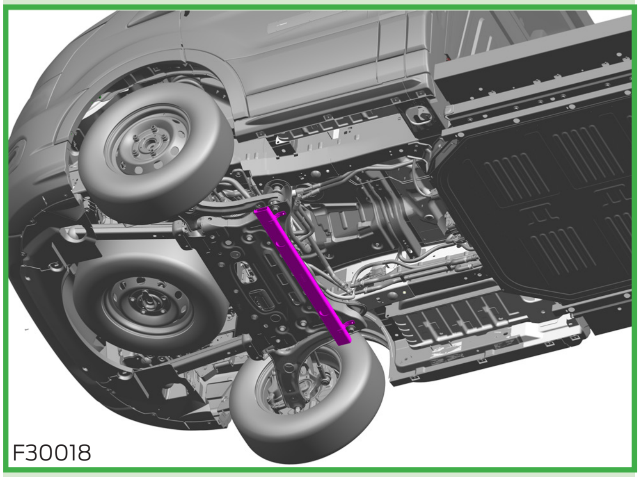
Battery Protection Bar

CAUTION: The E-Transit Van and Chassis Cab Variants have a front-mounted Battery Protection Bar to protect the battery from hitting the road surface where ground clearance is an issue. The Battery Protection Bar must NOT be removed

Battery Protection Bar: Location - Standard Range Battery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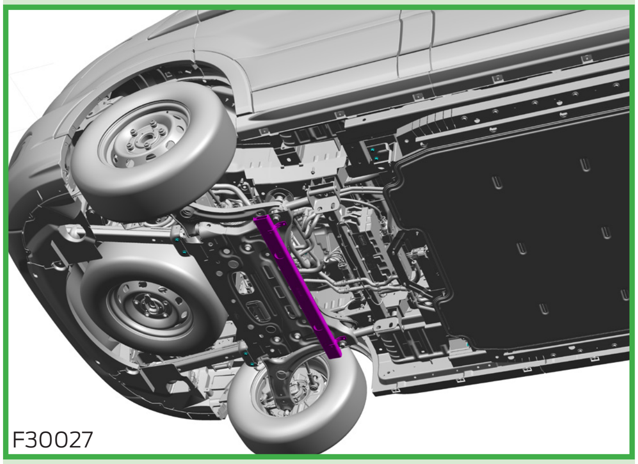
Battery Protection Bar: Location - Enhanced Range Battery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3.7.7 EV Charging

Please refer to the E-Transit Owners Manual

ePower Pack System

Please refer to the E-Transit Owners Manual

Mobile Charger Unit

Please refer to the E-Transit Owners Manual

NOTE: Charge cords provided with vehicles should be reserved for end customer use only, and not used during manufacturing or delivery processes, to prevent damage or loss

NOTE: The standard charge cord storage location is lost if the passenger seat delete option is chosen and the upfitter must provide their own storage feature for the cord

4.1 Electrical System Overview

WARNINGS:

⚠ **It is recommended to follow the guidelines in the electrical sections of the BEMM. Incorrect design, for example: overloaded ground paths or insufficient mechanical protection to a third party wiring, could lead to serious system or vehicle failure.**

⚠ **The fitting of voltage boosters or other devices to enhance alternator output are not allowed. The fitting of such devices will not only invalidate vehicle warranties, but could damage either or both, the alternator and Engine Management System/Power Control Module, and possibly affect vehicle legal compliance. Check local legislation.**

⚠ **Do not fit an additional Front End Accessory Drive (FEAD) to vehicles already fitted with an Air Conditioning System Compressor.**

NOTE: Ford Motor Company has no control over the modification or installation process of the electrical content of auxiliary systems and therefore can take no responsibility for such installations.

NOTE: For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com

4.2 Wiring Installation and Routing Guides

4.2.1 Wiring Harness Information

NOTE: Ford Motor Company has no control over the modification or installation process of the electrical content of auxiliary systems and therefore can take no responsibility for such installations.

The following provides an installation guide for any electrical modifications or additional systems being added to the vehicle. The aim is to maintain robust integration of auxiliary systems without compromising existing systems, in areas such as splicing techniques into existing wiring, module package location and EMC issues. It is also expected that the vehicle modifier will test their installation and comply with all legal and homologation requirements.

4.2.2 General Wiring and Routing

Temperature requirements: Wiring systems in the vehicle interior are expected to function over the temperature ranges of –40ºF to 185ºF (-40ºC to 85ºC) for exposure and –40ºF to 167ºF (-40ºC to 75ºC) for function. For engine compartment and underbody, the minimum temperature is -40ºF (-40ºC), while the maximum exposure and operational temperatures are 257ºF (125ºC) for exposure and 221ºF (105ºC) for operational.

Make sure that the insulation is compatible with any fluids it may encounter, for example: gasoline, oil, antifreeze, brake fluid, transmission fluid and power steering fluid.

If a connector will be located in a hostile environment or wet area use a sealed connector. 'Hostile environment' areas include the engine compartment, wheel wells, underbody and doors.

Do not route wires near weld points or weld flashes. A minimum of 0.6" (15mm) clearance to any sheet metal welds under static and dynamic conditions is required. However, it is best to avoid routing near weld points or weld flashes at all times.

In general, the distance between retention points for wiring not contained in a rigid shield should be less than 11.8" (300mm).

A minimum 1" (25mm) clearance is recommended from all sharp edges and a minimum 1.4" (35mm) clearance of all moving parts of the parking brake assembly. If these clearances can not be met, protect the wires with a convolute.

For vehicle modifications with walkthroughs, it is recommended to provide appropriate protection on the floor in the walkway.

4.2.3 Connector Pin Out Practices

When designing a harness to component connection, it is best practice to put the female terminals in the harness side connection and the male terminals in the component side. When determining connector pin outs, make sure that power and ground circuits are not in close proximity, adjacent, to one another. A minimum separation of 0.2" (5mm) between power and ground circuits is required.

⚠ **WARNING: Do not use connectors which cut through the outer covering and into the core wire.**

❗ **CAUTION: It is recommended to only use Ford approved connectors.**

Cutting into vehicle wiring is not permitted because:

- The base vehicle specification is unsuitable for incremental loads except in conjunction with Auxiliary Fuse Panel
- Long term risk of a faulty connection developing
- Potential fire risk from overloading

All connections into existing wiring must be permanently insulated. Exterior connections must be waterproof.

When designing electrical circuits, or making alterations, the following must be considered:

- Current rating of wiring, see table 'Current Rating of Wire Sizes' in this section
- Any voltage drop in the circuit should not lower the terminal voltage at consumption point to below 95% of battery voltage
- Do not cut into the original harness
- Additional grounds should be included to support new equipment
- A supplementary circuit diagram and accompanying instructions should be added to the Owner's information or a separate manual supplied with the vehicle for each unique component

NOTE: For further information please contact bbasqa@ford.com

4.2.4 Unused Connectors

The harnesses may have a number of unused connectors, which are dedicated to other features and options, for example heated seats, but are not always present depending on level of harness fitted. Ford does not recommend the use of these connectors for any other purpose than that intended by design.

4.2.5 Grounding

If a new grounding point is required, avoid placing it in a wet area, especially for high current grounds. Ground connections should be routed back close to the location of the +12V supply. This helps to reduce the electromagnetic field particularly generated by inrush current and improve electromagnetic compatibility.

Drill point screws are not to be used for any ground attachments:

- Do not ground to moving structures, for example:

doors, deck lids, lift gates, as the ground return path through the hinges is not reliable

- Do not place more than 2 eyelet terminals under a single ground screw

Refer to: 4.5 Battery and Cables

- Do not place electrical component attachments or ground nuts adjacent to vehicle fuel tanks or fuel lines
- Each individual third party load must have a dedicated ground connected directly to the vehicle body ground or to the battery negative spare stud - see ‘Additional Loads and Charging Systems’ later in this section of the BEMM
- Multiple grounds must not go to an interim splice to a main ground cable
- If additional ground studs are required it is recommended to install a busbar with multiple studs fed directly from the battery ground post. See ‘Additional Loads and Charging Systems’

4.2.6 Prevention of Squeaks and Rattles

Wiring should be positively retained every 5.91 to 9.84” (150 to 250mm). All connectors should be positively retained. Use tapes which do not squeak against metal or plastic.

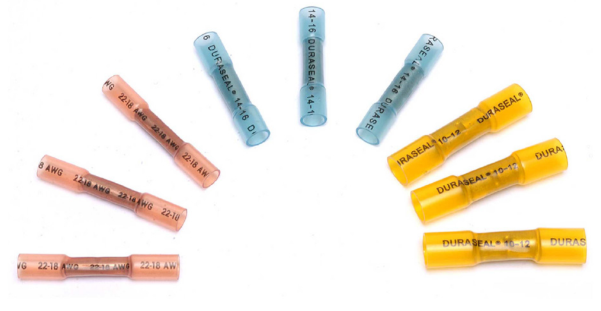
4.2.7 Water Leakage Prevention

Make sure that drip loops are provided to prevent water leakage into the vehicle interior, passenger and cargo compartments, using wiring assemblies that pass from outside into the vehicle interior. The drip loop is a section of wiring that is deliberately formed and routed BELOW the point of entry into the vehicle, so that gravity assists in forming water droplets that escape from the lowest part of the wiring.

Wiring from door to passenger compartment, should be made such that the door entry point is below the passenger compartment entry point, which creates a type of drip loop.

4.2.8 Wiring Splicing Procedures

TYCO-RAYCHEM crimp splices



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Ford Motor Company strongly advises against the use of wire splicing due to the variable and unpredictable nature of making robust, durable and reliable connections. However, if it is deemed that a wire splice is absolutely unavoidable, it must be made with **DuraSeal Heat-Shrinkable, Environmentally Sealed, Nylon-Insulated Crimp Splices** (manufactured by TYCO-RAYCHEM). For example the D406 series. As a further process to improve the splice integrity, the splice should be further sealed with a suitable heat shrink tubing. See Figure E131081.

4.2.9 Wiring Specification

NOTE: The maximum continuous current (A) values for 86ºF to 122ºF (30ºC and 50ºC) is a value below the maximum fuse rating allowed for the cable. This is because the fuse/cable system values at these temperatures are the continuous usage where as the maximum fuse also needs to protect for high current short term loadings such as electric motors.

When designing wire installations for additional

Current Rating of Wire Sizes

		Maximum Continuous current (A)	
Cross Sectional Area	**mOhms/m@68ºF**	**86ºF**	**122ºF**
0.35	54.4	7	4.9
0.5	37.1	11	7.7
0.75	24.7	14	9.8
1	18.5	19	13.5
1.5	12.7	24	17.0
2.5	7.6	32	22.7
4	4.71	42	29.8
6	3.14	54	38.3
10	1.82	73	51.8
16	1.16	98	69.6
25	0.743	129	91.6
35	0.527	158	112

equipment use the cable size recommended by the equipment manufacturer or select a suitable size from the 'Current Rating of Wire Sizes' table.

4.2.10 Electromagnetic Compatibility (EMC) Awareness

WARNING: Do not route other wiring near/ close to electrical cables with the Anti-Lock Brake System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang extra wiring off existing looms or tubes.

The installation and routing of Ford wiring has been fully-validated and has passed the requisite EMC tests. Ford Motor Company, however, are not responsible for the vehicle's EMC immunity when non-Ford-approved systems are installed.

Wiring must be suitably fixed without any detrimental effect on other wiring.

Single or bunched looms must maintain the following clearances:

- 0.4" (10mm) from static components (unless clamped to it)
- 9.8" (250mm) from exhaust system
- 1.2" (30mm) from rotating or moving components

4.2.11 Wiring through Sheet Metal

WARNING: Harnesses passing through sheet metal must be through protective grommets that also ensure a watertight seal. A windscreen type sealer should be used. Adhesive or tape is not acceptable.

NOTE: Holes must permit the appropriate connector to pass through.

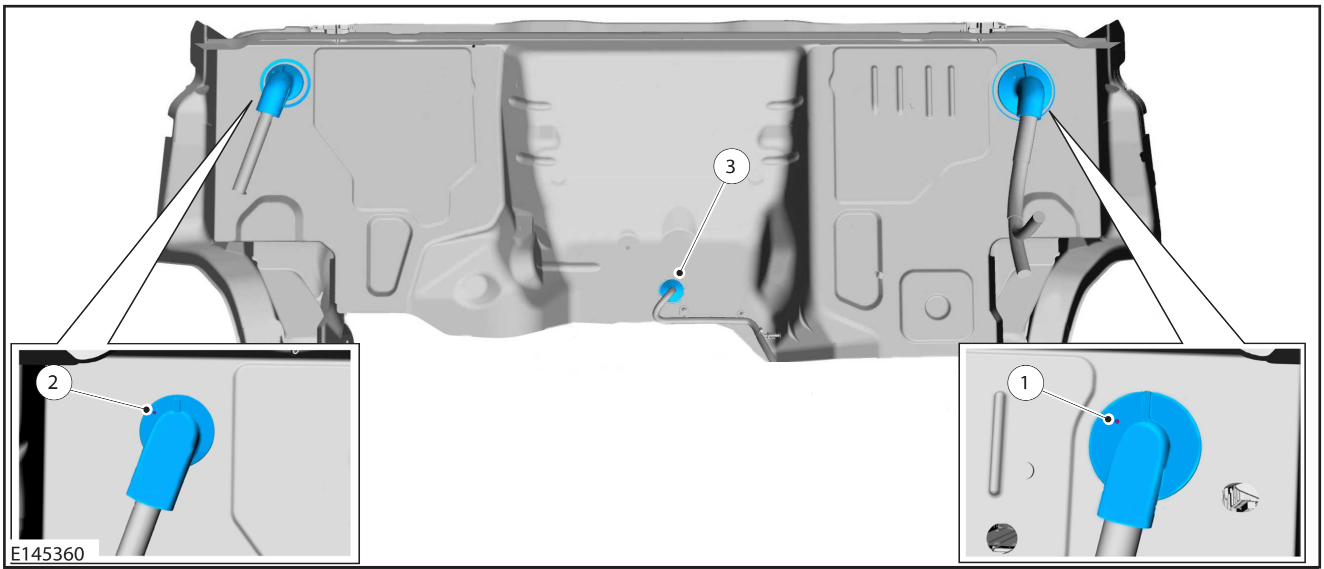
NOTE: The maximum size of additional wire bundle diameter is 1/4" (6mm).

There are three locations in the dash panel which have been identified for additional holes to route wires through. See figure E145360 (view from engine bay) for locations. The number of suitable locations will depend on the vehicle specification.

The grommets in locations 1 and 2, shown in figure E145360, are moulded directly to wire bundles in polyurethane foam material. It is not possible to feed extra wires through with the wire bundle. The grommets have an 'indent' molded into the surface face, engine bay side, which show the positions where an additional hole can be made using the following procedure:

- Check that the immediate surrounding area is free from obstructions and/or components to prevent damage to critical systems
- Use a suitable tool, for example: a drill or spike bit.
- Insert the drill or spike bit, horizontal and parallel, through the indent of the grommet, making sure not to extend further than 1" (25mm) through the grommet surface, this will help eliminate any possible damage to items on the passenger side of the grommet

Dash Panel (Viewed from Engine Bay)



Item	Description
1	Dash Grommet Left Hand Side
2	Dash Grommet Right Hand Side
3	This location is available

4.2.12 Precautionary Drill Zones - High Voltage (HV) Cables

WARNINGS:

Do not touch, drill, modify or obscure the orange High Voltage cables, fasteners, channels, strain relief, ground wire or connectors

Fasteners that upfitters install must point away from the battery so as to not to cause damage to the battery. Do not add a fastener into the vehicle that would point toward the HV Battery

No components or structure installed by an upfitter shall result in contact, penetration (especially added fasteners pointed towards the high voltage battery or other electrical components), separation, or other damage to the high voltage electrical system or any portion thereof when the vehicle is tested in any manner.

Do not modify the High Voltage Charge Port Inlet Connector/Mounting Bracket

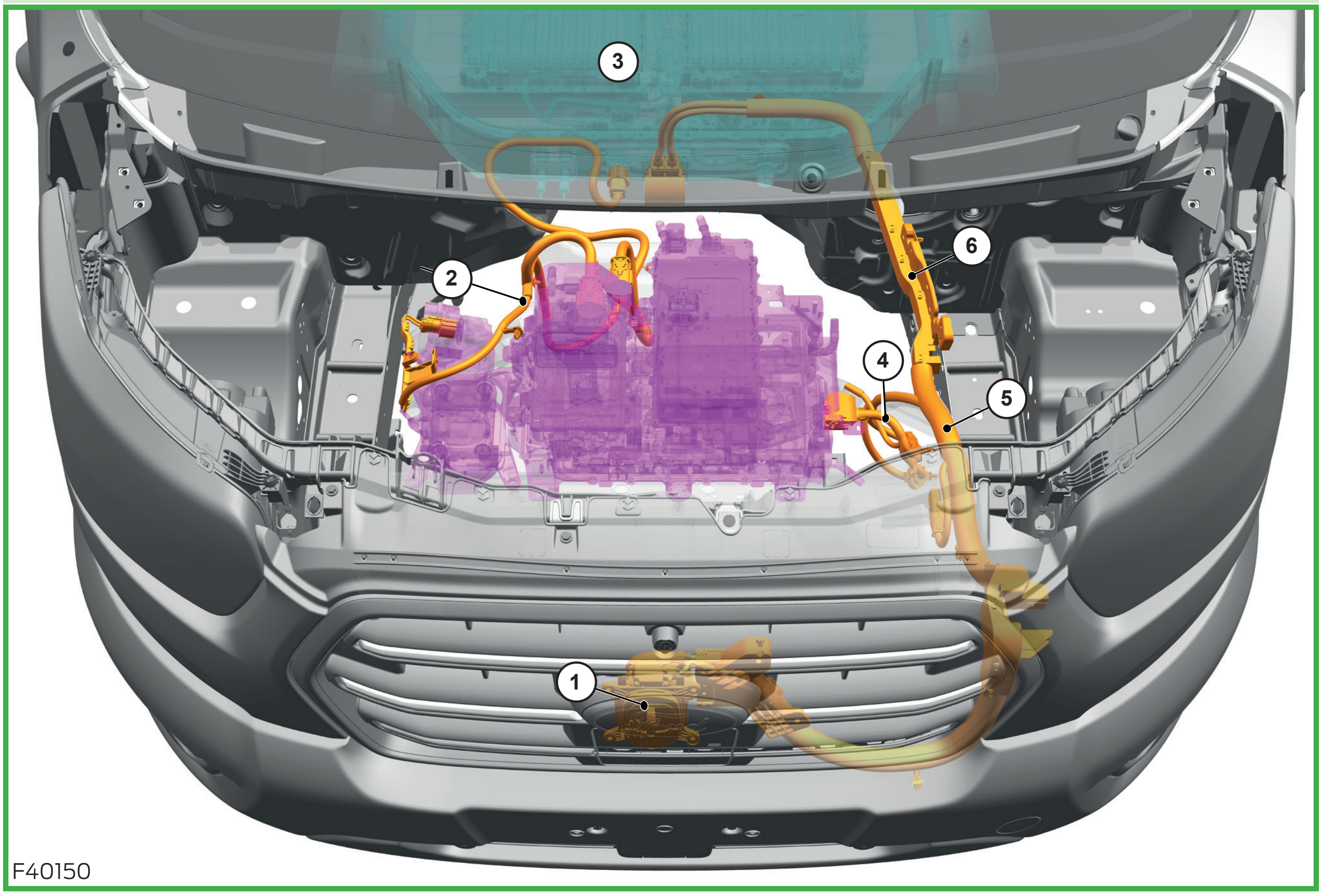
Do not modify these High Voltage/Low Voltage grounding locations/joints/fasteners of the Charge Port Harness Package Grounds

Do not modify the length of any of the orange high voltage cables

Do not remove fasteners and protective shield from the Charge Port Inlet Harness

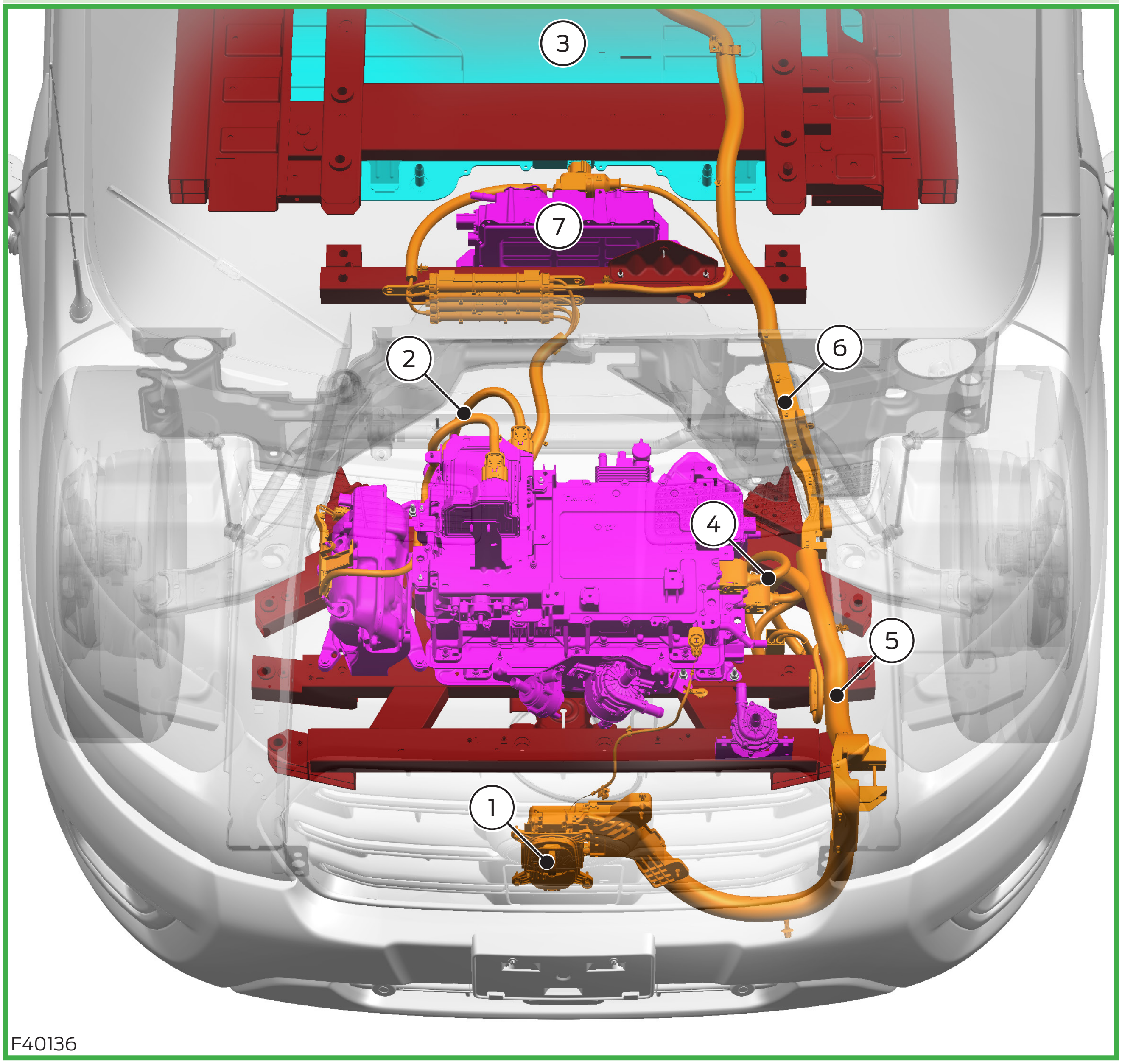
CAUTION: Take precaution when undertaking drilling or any other operation in or near any HV cable to prevent damage.

Front End High Voltage Wiring Package - Standard Range Battery



Item	Description
1	High Voltage Charge Port Inlet
2	Accessory Harness
3	High Voltage Battery Pack
4	Battery Charger Inline Jumper
5	Charge Port Harness
6	Charge Port Harness Protective Shield

Front End High Voltage Wiring Package - Enhanced Range Battery



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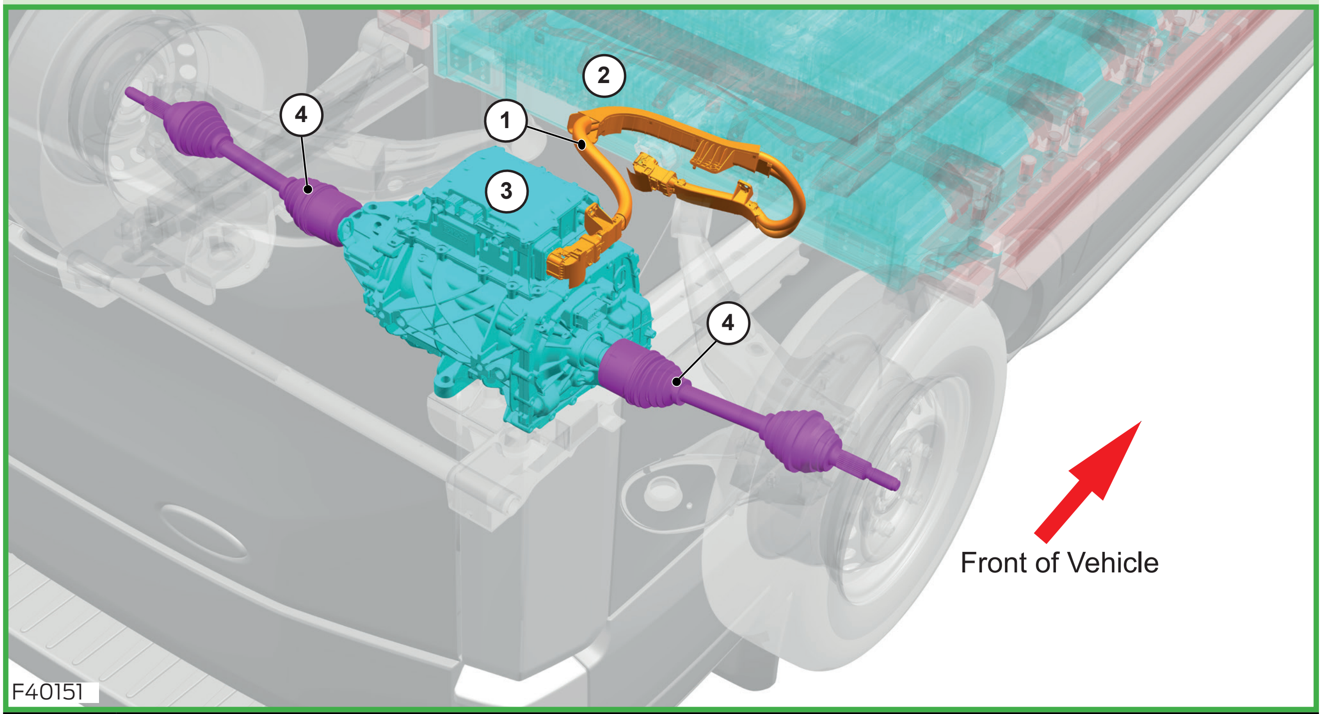
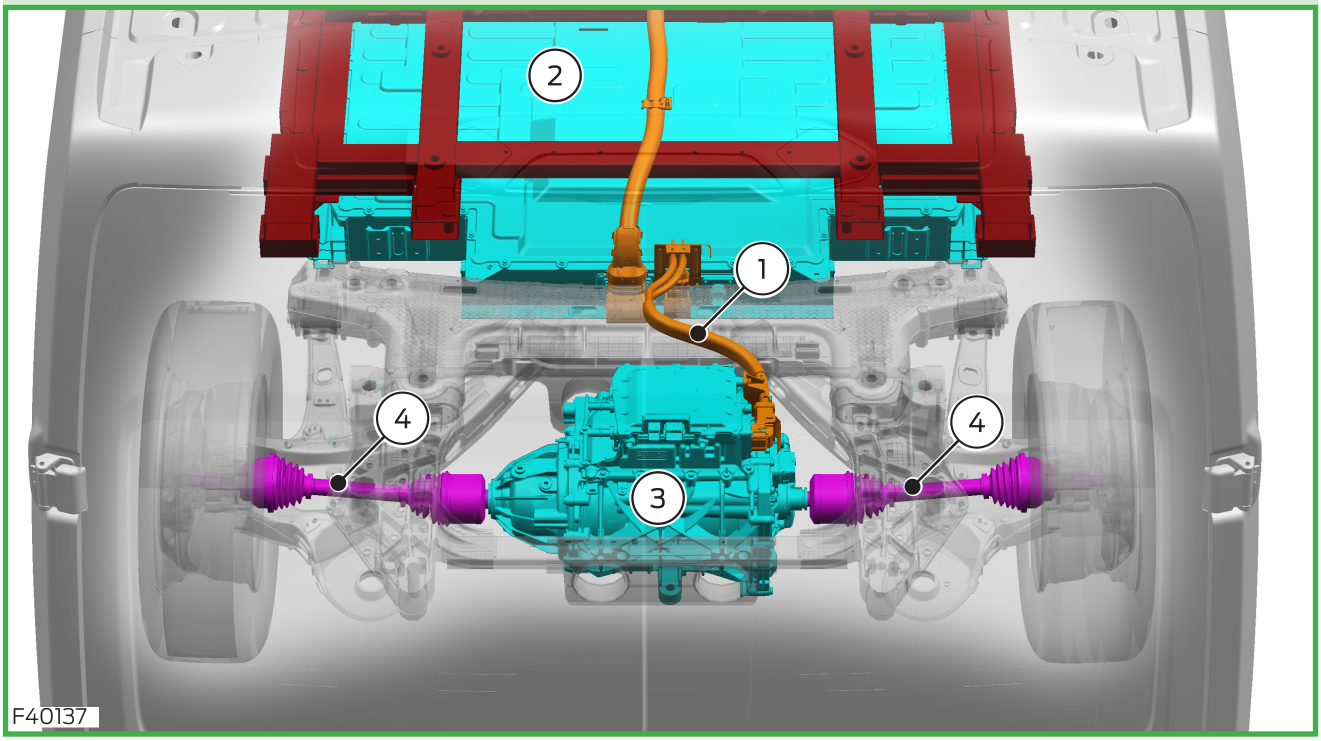
Item	Description
1	High Voltage Charge Port Inlet
2	Accessory Harness
3	High Voltage Battery Pack
4	Battery Charger Inline Jumper
5	Charge Port Harness
6	Charge Port Harness Protective Shield
7	On Board Generator Inverter (OBGI) Module (optional)

Rear End HV Cable Package - Standard Range Battery



Item	Description
1	Electric Drive Assembly to High Voltage Battery Cable
2	High Voltage Battery Pack
3	Electric Drive Assembly
4	Halfshaft

Rear End HV Cable Package - Enhanced Range Battery



Item	Description
1	Electric Drive Assembly to High Voltage Battery Cable
2	High Voltage Battery Pack
3	Electric Drive Assembly
4	Halfshaft

4.2.13 Precautionary Drill Zones - HV Modules LV Cables and Connectors

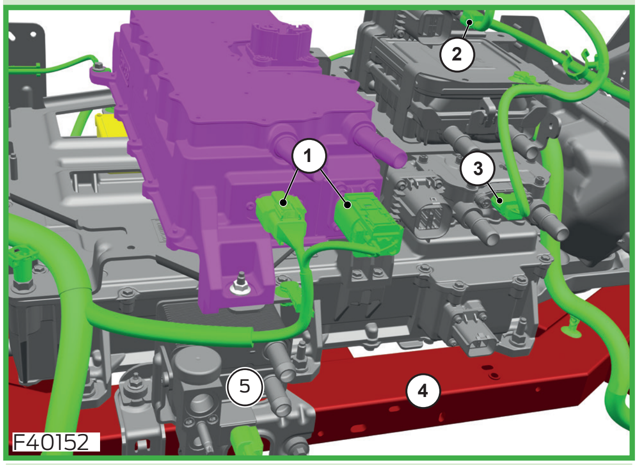
CAUTION: Beware when drilling or undertaking any operation near the LV cable that connects to the High Voltage modules, as this could negatively impact vehicle performance. The LV cable also includes a ground for HV components.

WARNINGS

Take precautions when drilling or undertaking any other operation in the areas indicated ,in order to prevent damage to any components

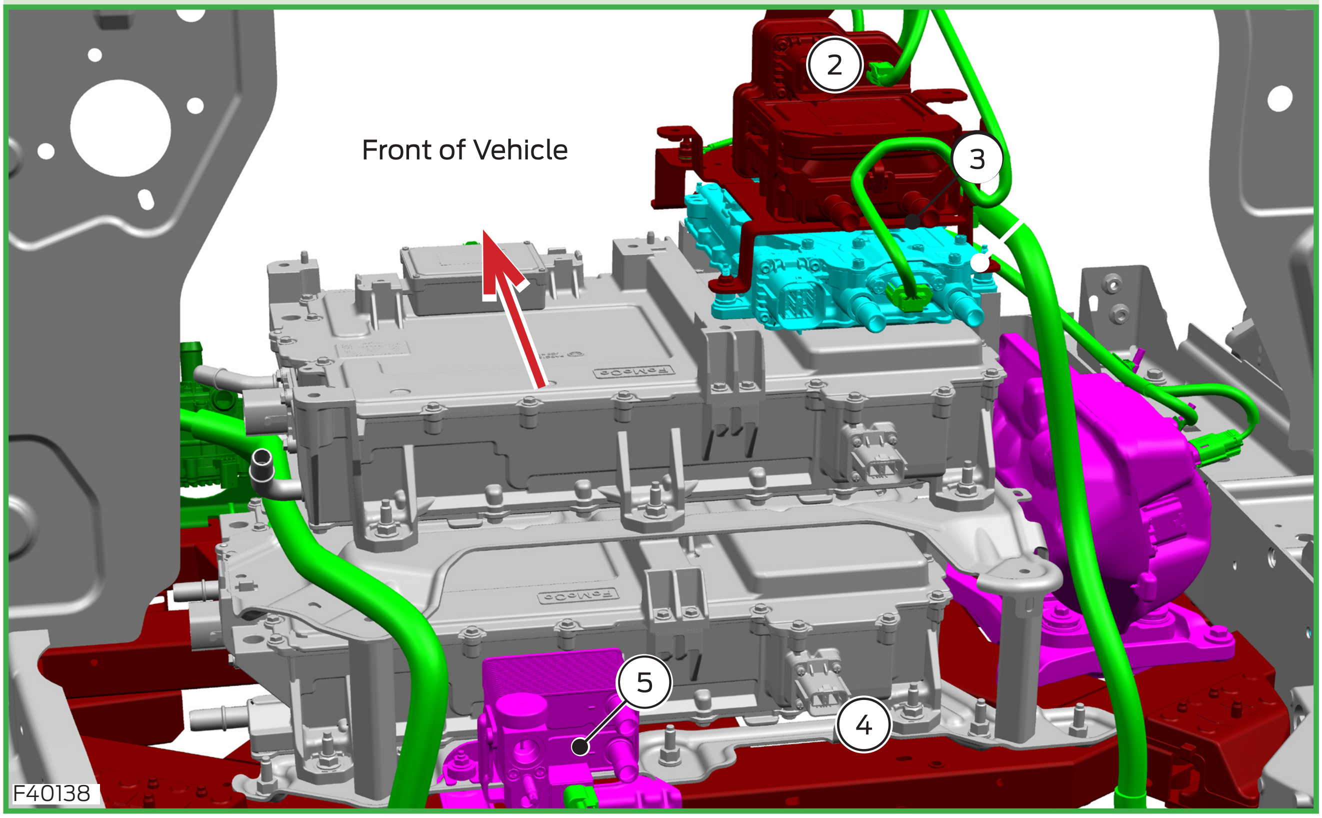
Do not modify any existing Low Voltage Cable cable/connections

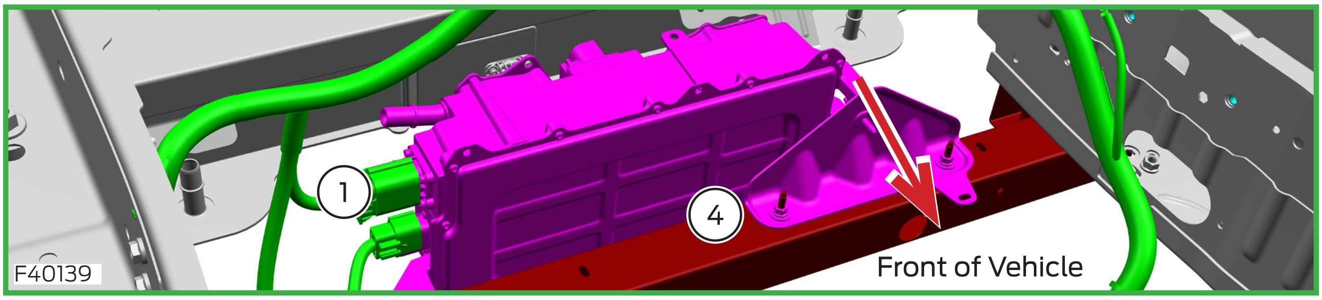
LV Connectors: Rear of HV Stack - Standard Range Battery



Item	Description
1	Low Voltage Connector to On Board Generator Inverter
2	Low Voltage Connector to Electric Heater
3	Low Voltage Connector to DC-DC Converter
4	Megabrace
5	Low Voltage Connector to Auxiliary Chiller

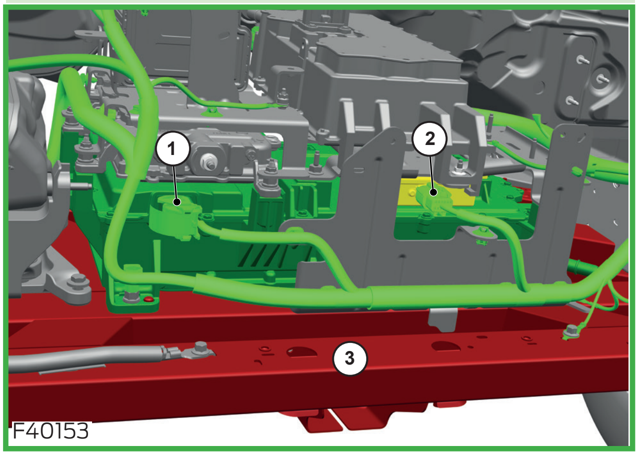
LV Connectors: Rear of HV Stack - Enhanced Range Battery (refer to above table)





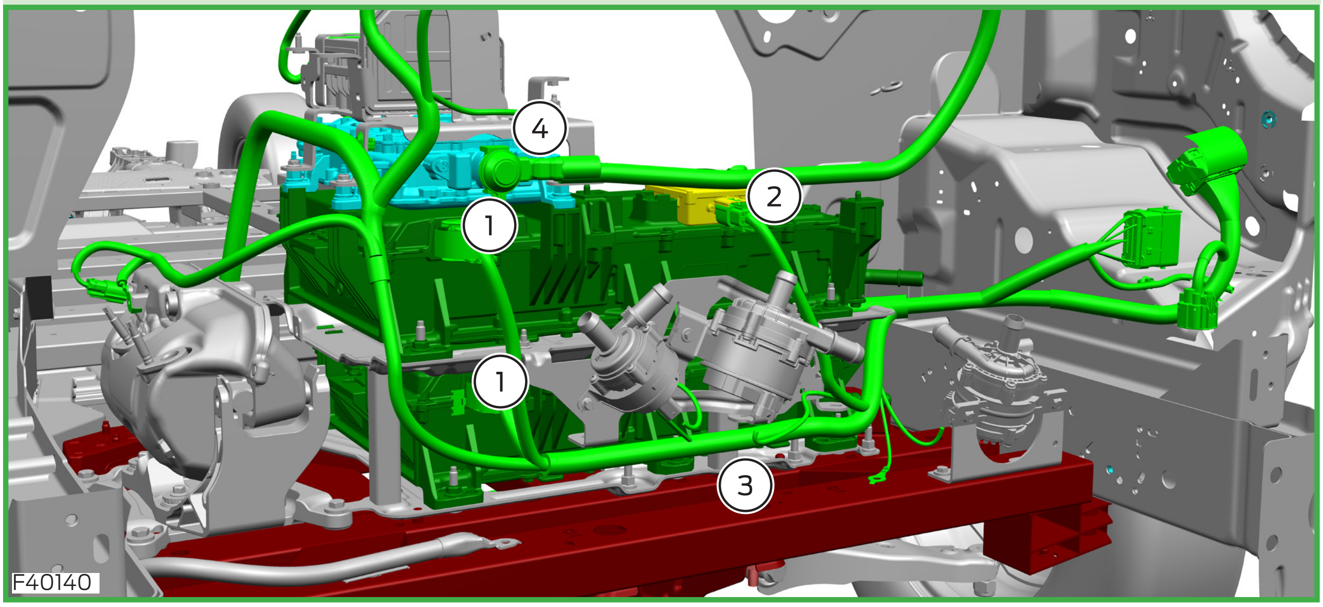
🟩 Abc = BEV Only 🟦 Abc = ICE Only

LV Connectors: Front of HV Stack - Standard Range Battery



Item	Description
1	LV Connector to Charger
2	LV Connector to OBCC
3	Megabrace

LV Connectors: Front of HV Stack - Enhanced Range Battery



Item	Description
1	Low Voltage Connector to Charger
2	Low Voltage Connector to Off Board Charger Control
3	Megabrace
4	Low Voltage Connector to DC-DC Converter

4.2.14 Precautionary Drill Zones - Cable Grounding

WARNINGS:

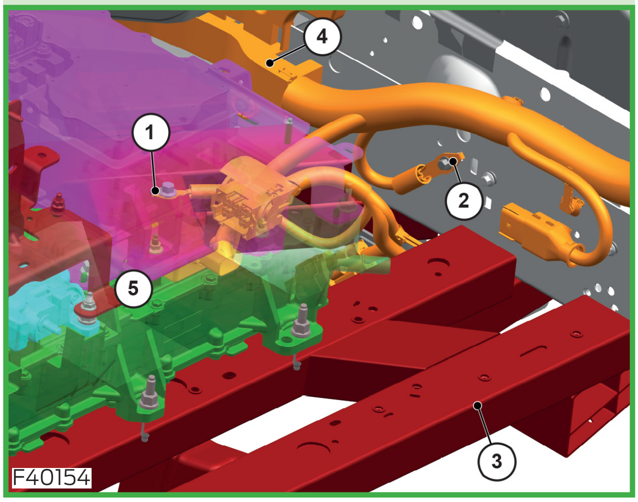
Take precautions when undertaking drilling, or any other operation, in or around the high voltage stack or electric drive assembly in order to prevent damage to any components. HV grounding points in the vehicle are not to be touched.

Do not modify any High Voltage grounding locations, connectors or joints.

On the E-Transit BEV, the High Voltage (HV) circuitry is not grounded to the body/ chassis in the same way as the Low Voltage (12V) system. As part of the safety features built in to the HV system, measurements between the HV circuitry and vehicle ground are measured using these ground paths. Therefore, HV module ground paths must not be altered in any way.

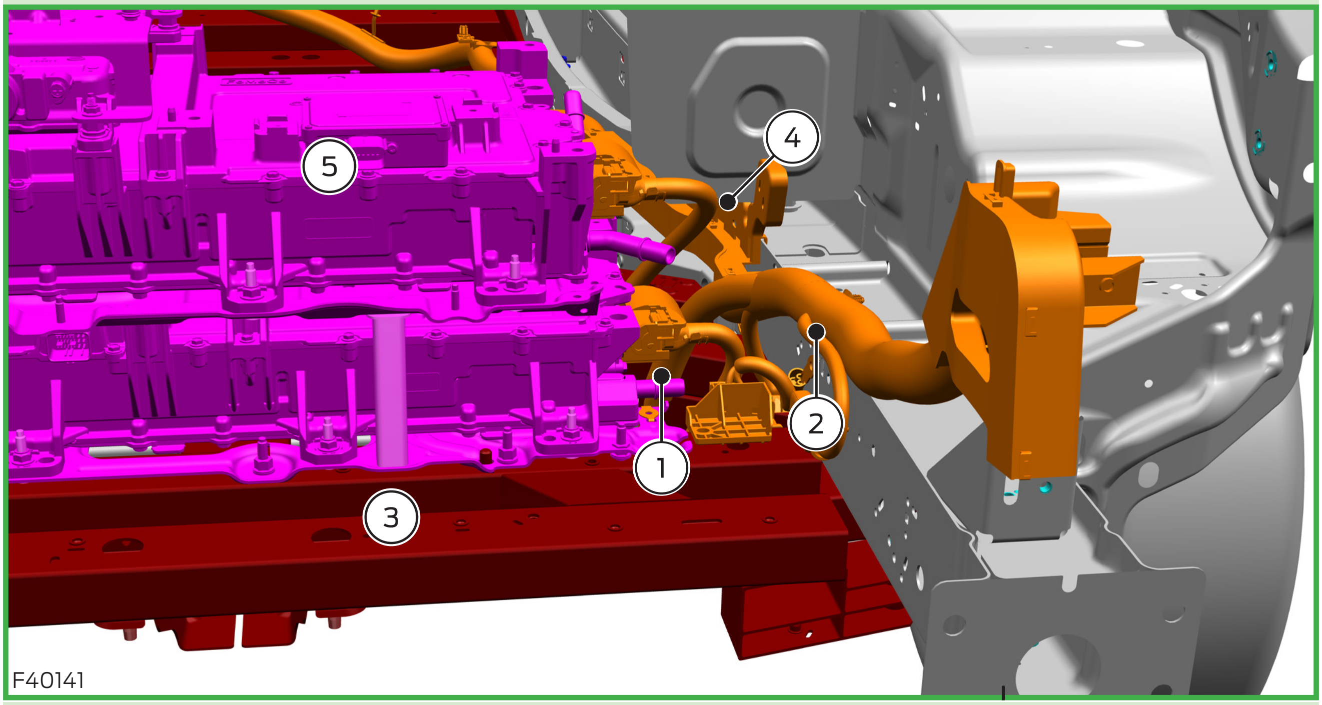
WARNING: Do not modify these High Voltage/Low Voltage grounding locations/ joints/fasteners of the Charge Port Harness Package Grounds

Cable Grounding: Charge Port Harness - Standard Range Battery



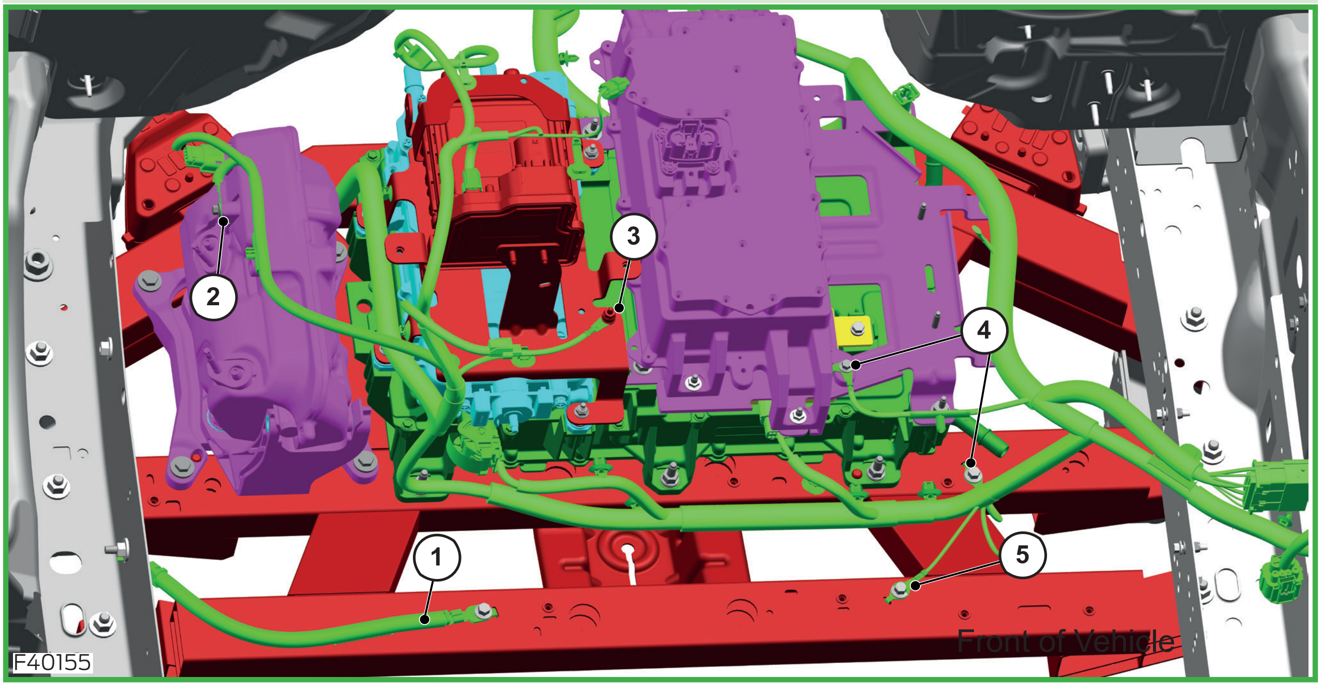
Item	Description
1	Harness Ground to Megabrace
2	Harness Ground to Chassis
3	Megabrace
4	Harness Protective Shield
5	High Voltage Stack

Cable Grounding: Charge Port Harness - Enhanced Range Battery (refer to above table)



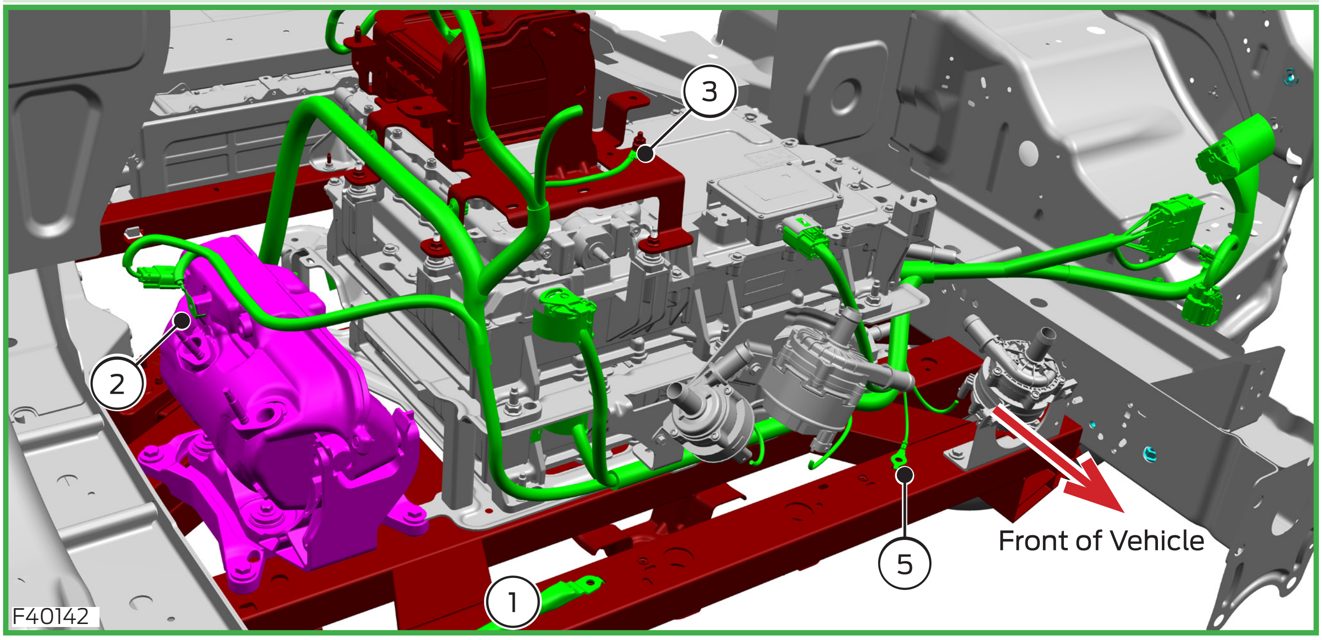
🟩 Abc = BEV Only 🟦 Abc = ICE Only

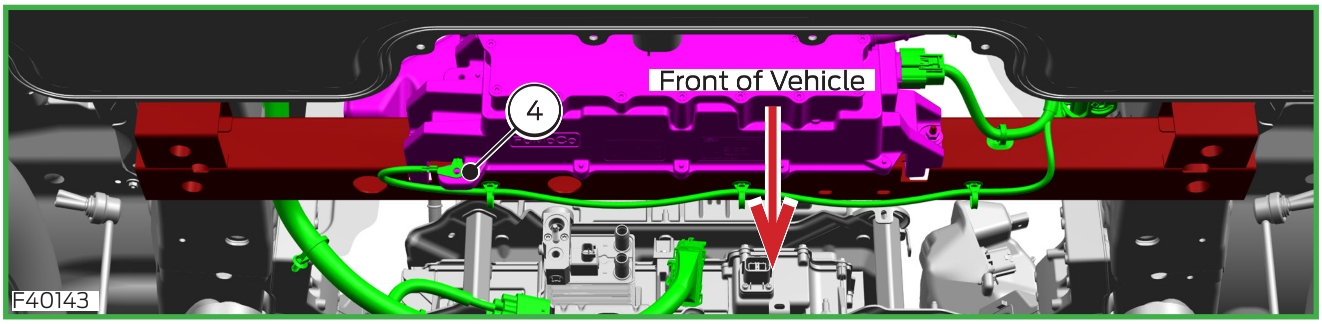
Cable Grounding: High Voltage Modules - Standard Range Battery


1
2
3
4
5
Front of Vehicle
F40155

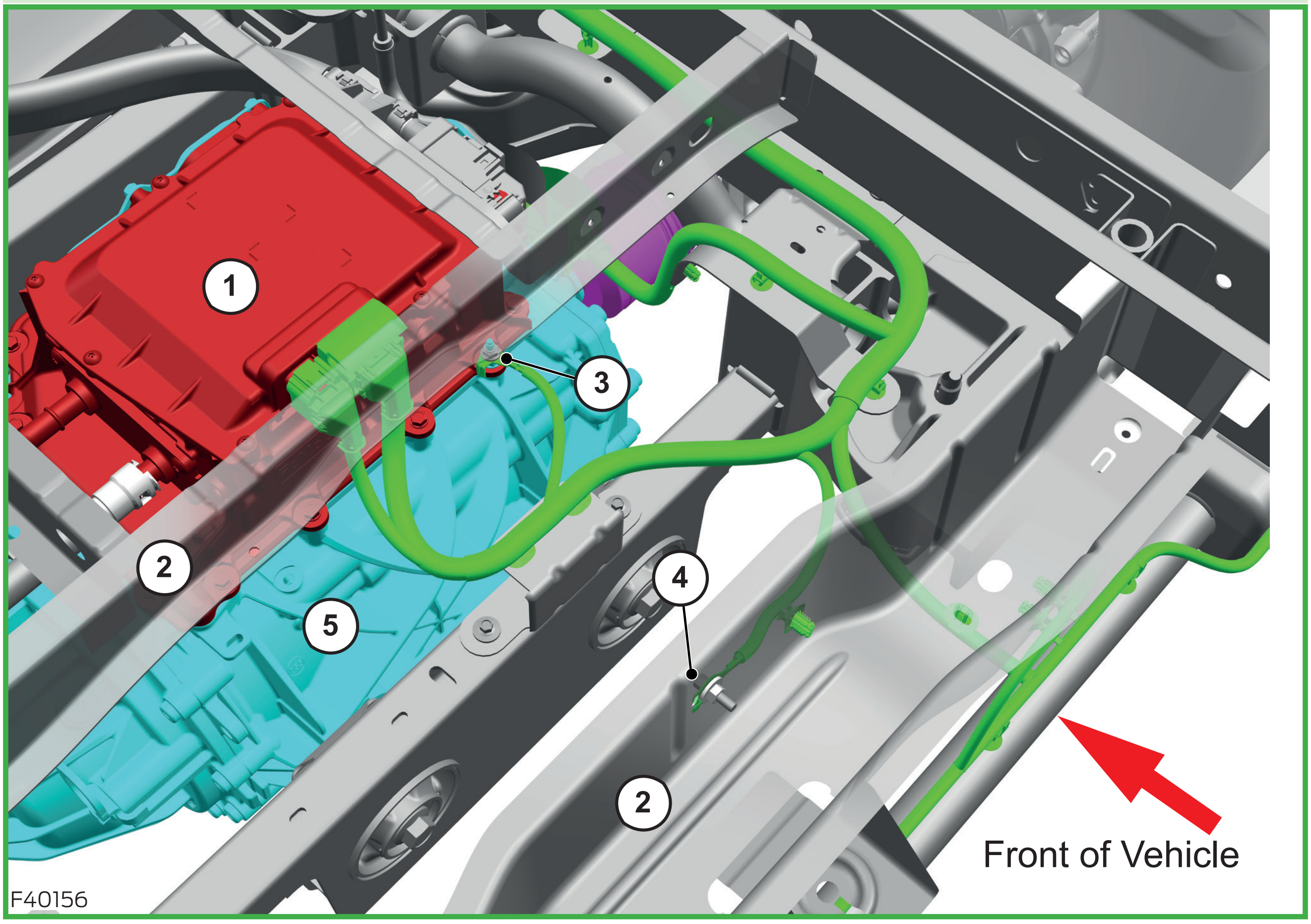
Item	Description
1	Megabrace Ground Strap to Chassis
2	Electric A/C Compressor Grounding
3	HV Electric Heater Grounding
4	On Board Generator Inverter Ground Strap to Chassis
5	EDS Grounding to Megabrace for Electric A/C Compressor and HV Electric Heater

Cable Grounding: High Voltage Modules - Enhanced Range Battery (refer to above table)


3
2
5
Front of Vehicle
1
F40142


Front of Vehicle
4
F40143

Cable Grounding: Electric Drive Assembly - Standard/Enhanced Range Battery



Item	Description
1	Inverter System Controller (ISC)
2	Chassis Crossmember
3	Inverter System Controller (ISC) to Electric Drive Unit
4	Inverter System Controller (ISC) to Chassis Crossmember
5	Electric Drive Unit

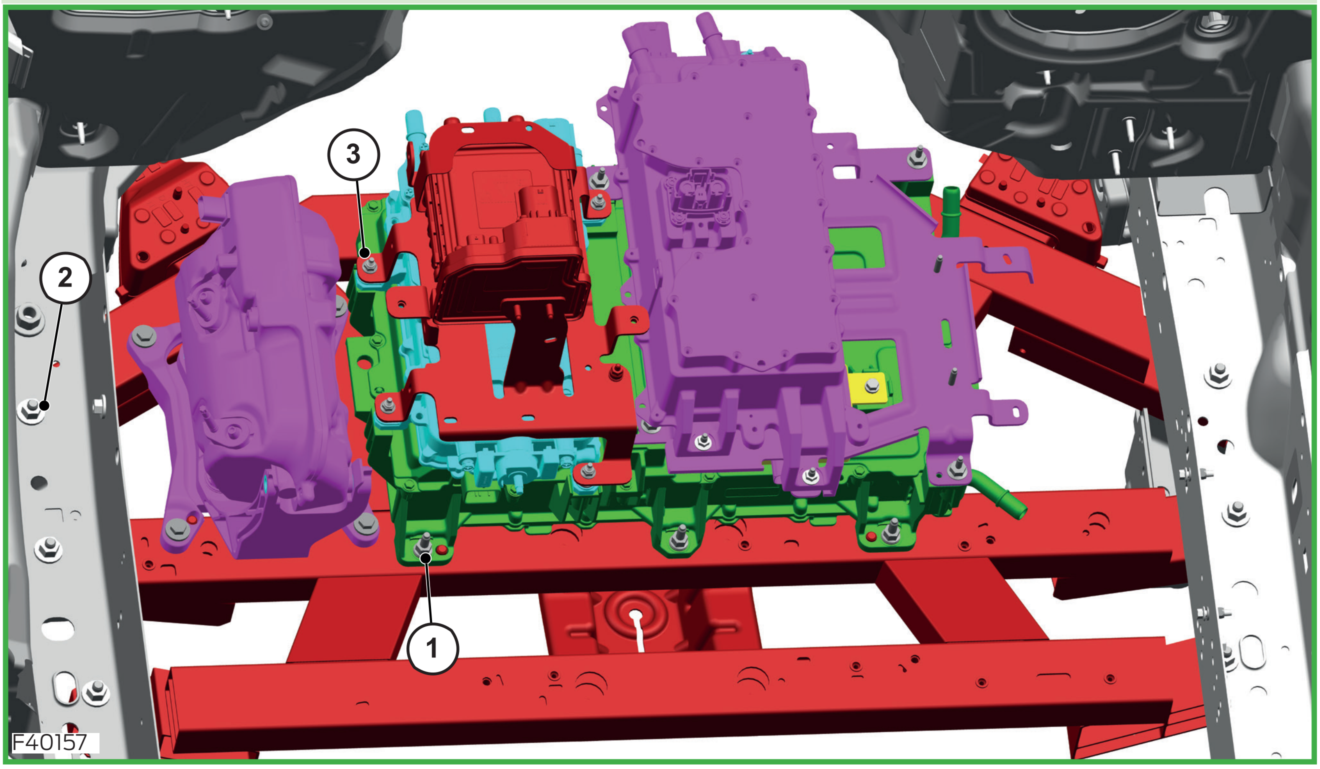
4.2.15 Precautionary Drill Zones - Chassis Grounding

⚠ **WARNING: Do not modify locations/joints of the Electric Drive Assembly Ground Path from the Inverter System Controller to the Electric Drive Unit or Chassis Crossmember**

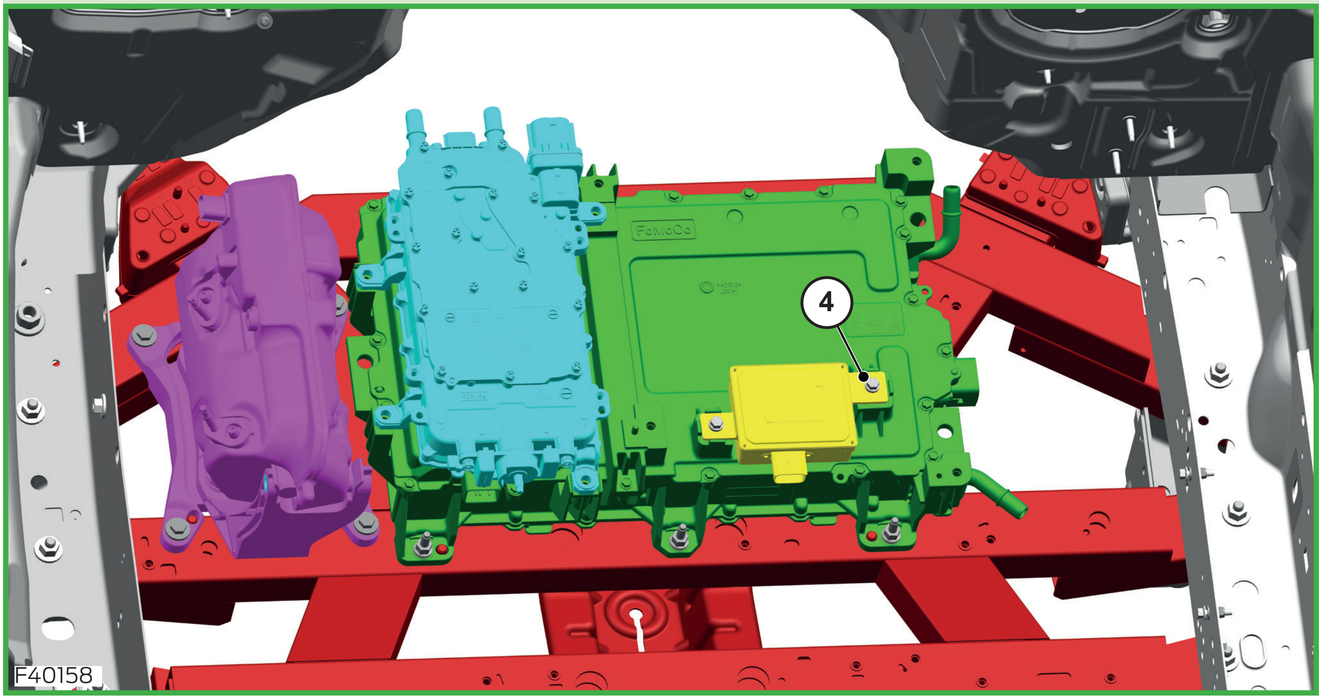
⚠ **WARNING: Do not modify High Voltage Charger to Charger Bracket chassis grounds**

⚠ **WARNING: Do not modify Charger Bracket to Megabrace chassis grounds**

Chassis Grounding: High Voltage Modules - Standard Range Battery

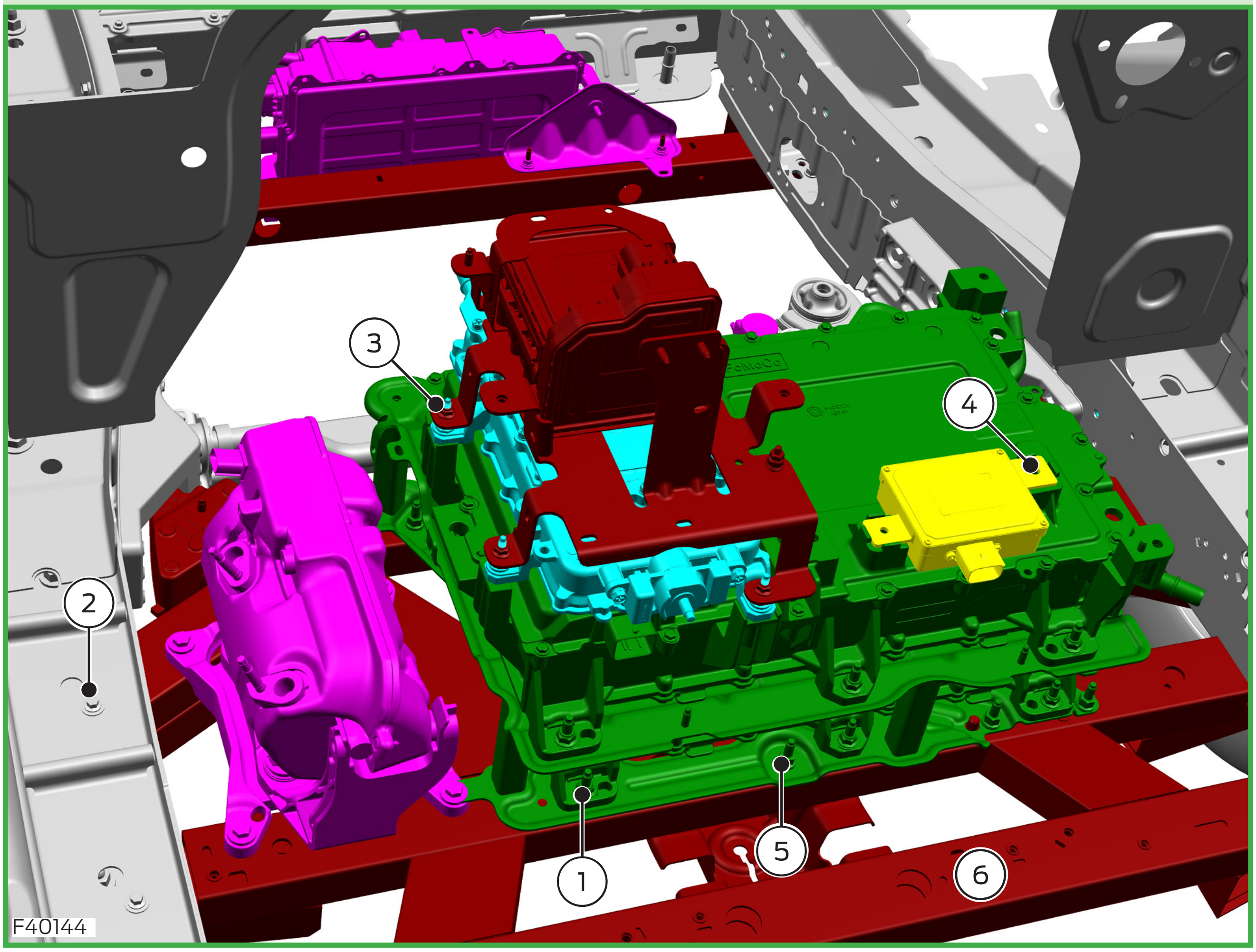


Chassis Grounding: High Voltage Modules - Standard Range Battery



Item	Description
1	High Voltage Charger to Megabrace - 6 Locations
2	Megabrace to Chassis - 6 Locations
3	DC-DC Converter to HV Charger - 4 Locations
4	Off-Board Charger Control Module (OBCC) to HV Charger

Chassis Grounding: High Voltage Modules - Enhanced Range Battery



Item	Description
1	High Voltage Charger to Charger Bracket - 6 Locations
2	Megabrace to Chassis - 6 Locations
3	DC-DC Converter to HV Charger - 4 Locations
4	Off-Board Charger Control Module (OBCC) to HV Charger
5	Charger Bracket to Megabrace - 8 Locations
6	Megabrace

Ford released hardware is available to support further installations to the vehicle. Only this hardware and released parts are to be used for this.

4.2.16 Precautionary Drill Zones — Rear Cargo Area

CAUTION: Do not drill into the vehicle before checking the precautionary drill zones and electrical wire routing.

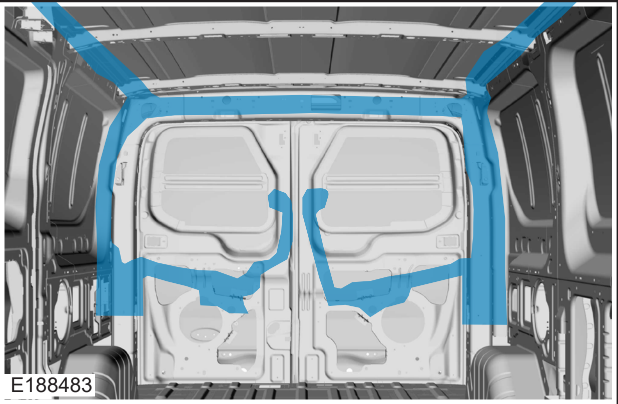
NOTE: Refer also to 5.12.2 B Pillar No Drill Zone for details of the restrictions in the area around the Seat Belt installation.

For vehicle wheelbase and roof height Refer to: 1.10 Package and Ergonomics

The areas marked in blue on figures E188483 - E188487 show the ‘Precautionary Drill Zones’ for the rear cargo area where there is wire routing. Caution should be taken when drilling in these areas to not damage wiring harnesses, (for example: when installing cladding and racking). The same care should also be taken when using self tapping screws. Not all derivatives are shown but the routing is the same for roof line and wheelbase with regards to ‘B’, ‘C’ and ‘D’ pillars or roof bows and doors. Other non electrical systems may also be present, for example: fuel tank under floor so it is important to check before drilling.

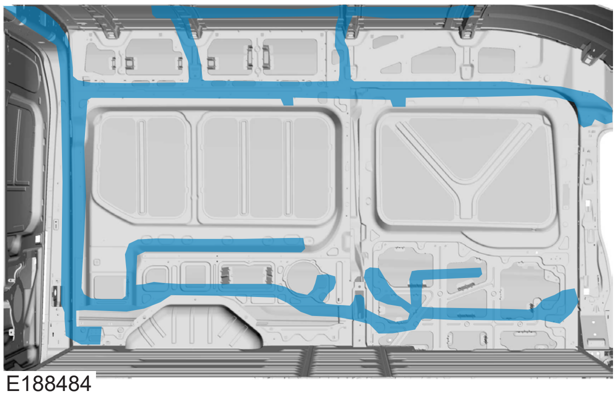
For additional information refer to the following links.
5.1 Body
5.1.4 Floor Precautionary Drill Zones
5.1.5 Floor No Drill/No Weld Zones
5.4.1 Load Compartment Tie Downs
5.3.1 Racking Systems
5.6 Body Closures for No Drill Zones - Closures.

Rear Cargo Doors /Low Roof



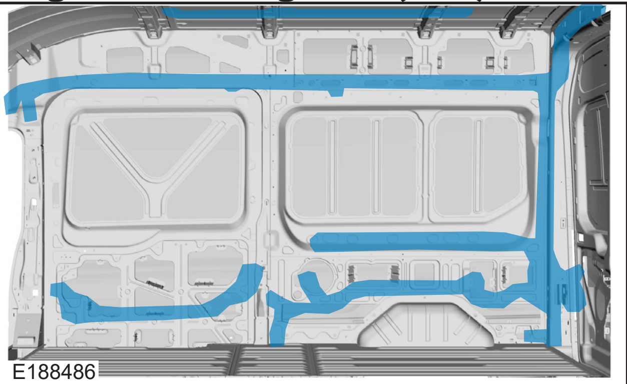
E188483

Long Wheelbase/High Roof (LHS)



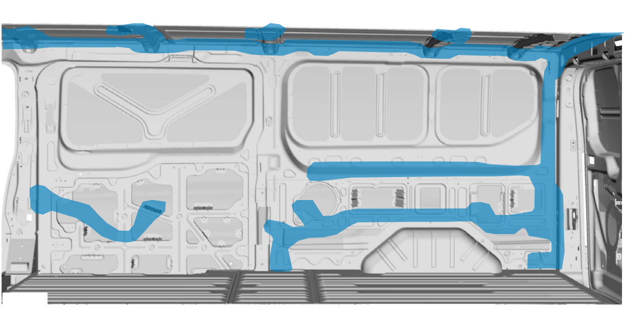
E188484

Long Wheelbase/High Roof (RHS)



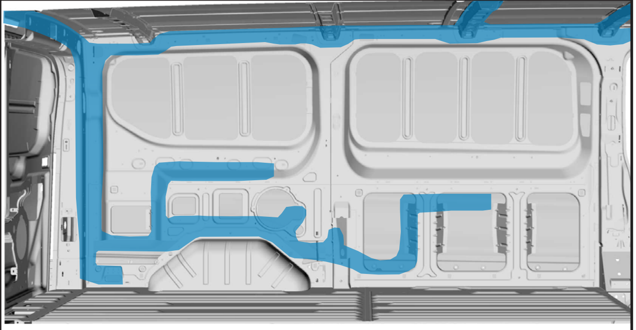
E188486

Side Load Doors/Long Wheelbase/Low Roof (RHS)



E188487

Medium Wheelbase/Low Roof (LHS)



E188485

4.2.17 Electrics for Tow Bar

Tow bar electrical system may be ordered as a 7-pin DIN connector, as part of the original vehicle build.

Where it is required to add trailer towing to an existing vehicle, and to ensure compliance with lighting regulations, the appropriate wiring accessory kit can be obtained from your Ford Dealer.

Fitment of non-Ford trailer tow wiring is not advisable due to Body Control Module control of lighting, and meeting legal lighting regulations. Contact your local Ford dealer for details of a harness that connects to the base vehicle harness.

NOTE: The Ford trailer tow system is integrated with the Ford park aid system. When a trailer is connected, the system communicates on CAN only, to deactivate reverse park aid feature, there is no hardwired interface. It is not possible to turn off reverse park aid with an aftermarket trailer tow system.

NOTE: For Van tow bars it is necessary to connect into the rear lamp unit.

NOTE: If tow bar connectors are not used, appropriate fixing and cover must be applied for protection from water and contaminant ingress.

NOTE: The trailer detect circuit is part of the Ford Trailer Tow module, it can only be implemented on vehicles with power locking and perimeter alarm.

The Trailer Tow Module (TTM) can support pure LED trailer lights as long as each circuit exceeds 500mA, below this and the system will not detect a trailer has been connected and shuts down all outputs (sleep mode). It is recommended to target a 550mA minimum load to allow for system tolerances. This would need to be obtained with a supplemental load resistor, if the LED lighting circuits are below this threshold.
A higher current is interpreted as short circuit. If a short circuit is detected the related output will be switched off. The following table shows the recommended output maximums per circuit.

The TTM has a battery charge of 30A. The feed is protected by a 30A fuse (not in TTLM but in the vehicle fuse panel). It is NOT protected for current overload. The fuse will blow if the current is exceeded. For following functions Delphi LED detection limit of typically 330mA (110mA - 660mA)

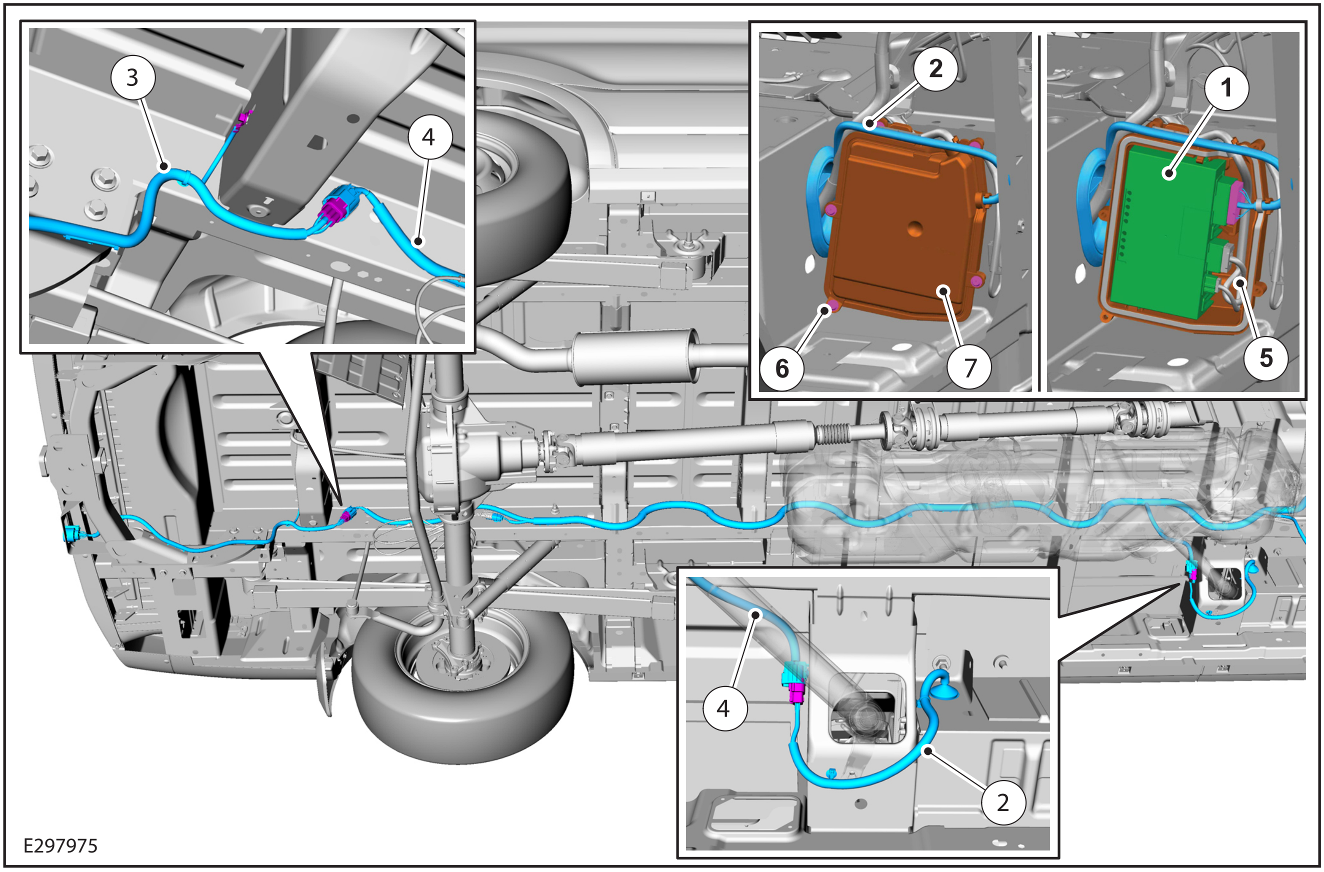
- Stop Light
- Turn Indicator

Summary of Current:

- Max load for Turn/Stop Lamps is 15A each
- Total module is 30A for Lamp loads

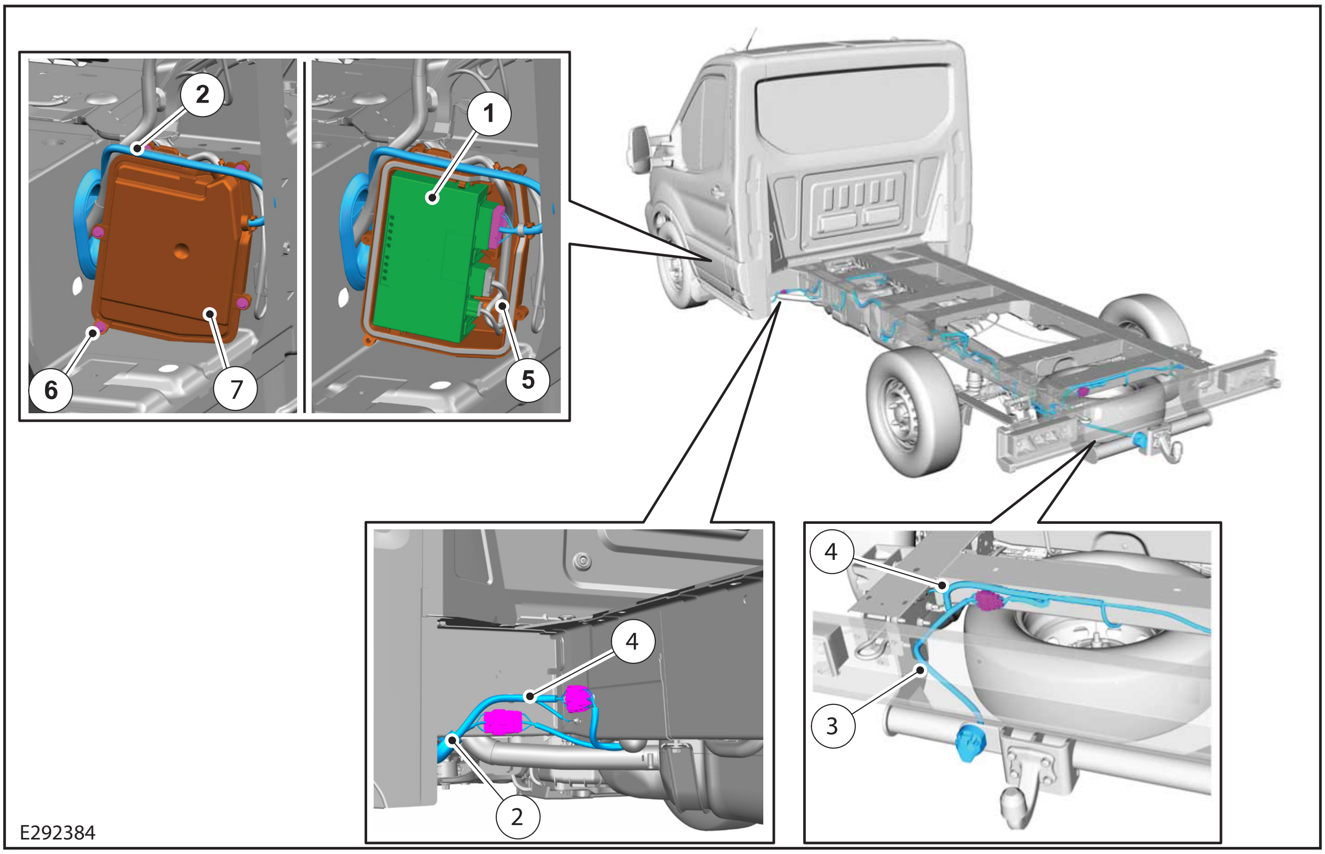
The Park/Reverse Lamp is a relay located in the vehicle not in the TRM module.
If trailer tow system is to be added, the correct wiring and module needs to be ordered. The vehicle needs to

Trailer Tow Module and Harnesses - Van, Wagon Vehicles



Item	Description
1	Trailer Tow Module
2	Trailer Tow Module Jumper
3	Trailer Tow Socket Jumper
4	Fuel Tank Harness
5	Main Harness
6	Screws (x5)
7	Trailer Tow Module box

Trailer Tow Module and Harnesses - Chassis Cab Vehicles



Item	Description
1	Trailer Tow Module
2	Trailer Tow Module Jumper
3	Trailer Tow Socket Jumper (Part of Trailer Tow Prep Pack)
4	Fuel Tank Harness
5	Main Harness
6	Ground Bolt fixing point (see also GP38 in '4.23 Grounding' section of this manual)
6	Screws (x5)
7	Trailer Tow Module box

have Central Car Configuration (CCC) programmed to the correct parameters:

CCC Parameter 20

- 0x01 without trailer tow
- 0x08 Trailer Module 7 - Pos Socket

NOTE: It is mandatory that a trailer is detected. Therefore at least one of the following lights have to be connected in the **on mode** or in the **standby mode** (anti-theft mode): Stop right, Stop left, Position lights or Direction indicator left.

Trailer connect will be detected if a load is detected on the Right Turn/Stop or Left Turn /Stop Lamps. If the current loads for either lamp are exceeded, the module will shut the driver off and send a message to the instrument cluster that the lamp driver has failed.

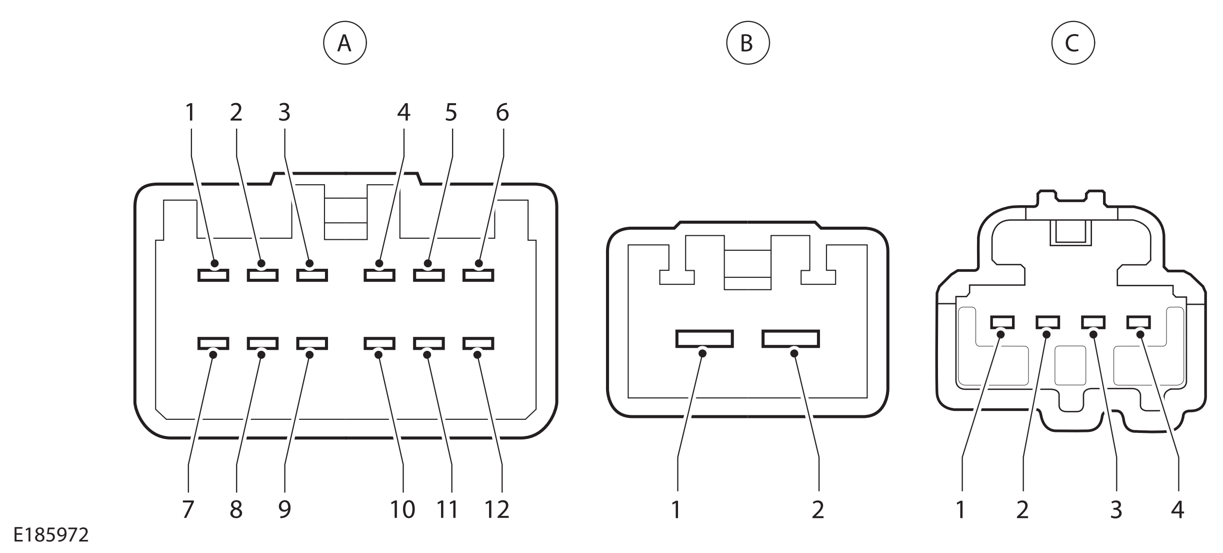
The module will also detect if either the right side or left side is open (for example the lamp is burned out).

If a short circuit is detected or an overheating of the drivers occurs, the related output remains off until an ignition cycle is performed and the engine is restarted.

The trailer detection uses a strategy of having a 1K ohm resistor if the lights are not actually switched on to detect that the trailer has been connected. If a trailer light is already switched on the related current will be checked.

NOTE: Extended wheelbase vehicles with less Trailer Tow option and have Fuel Harness CK4T-14406-RZ will not have the connector for Trailer Tow Socket Jumper

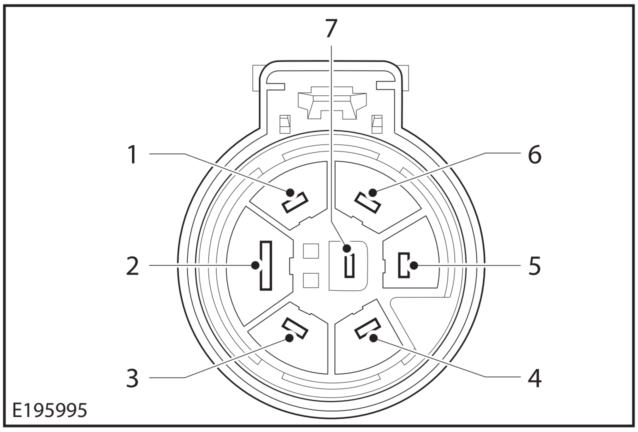
Trailer Tow Module Connectors



	Feature	Current (A)		Voltage (V)	
Component Terminal Number	Circuit Number	Min	Max	Min	Max
Connector A					
1	Left Turn Lamp/Stop Lamp	-	15	8	16
2	Not Used	-	-	-	-
3	Battery Charge	-	27.4	8	16
4	Not used	-	-	-	-
5	Not used	-	-	-	-
6	Not used	-	-	-	-
7	Not used	-	-	-	-
8	Right Turn Lamp/Stop Lamp	-	15	8	16
9	Not used	-	-	-	-
10	Not Used	-	-	-	-
11	Not used	-	-	-	-
12	Position Light	-	-	-	-
Connector B					
1	Battery Charge Feed	-	27.4	8	16
2	Term 30 (Vbat)	-	30.7	8	16
Connector C					
1	Ground	-	0.5	8	16
2	CAN L	-	0.1	8	16
3	CAN H	-	0.1	8	16
4	Trailer Detect Output	-	-0.013	-8	-16

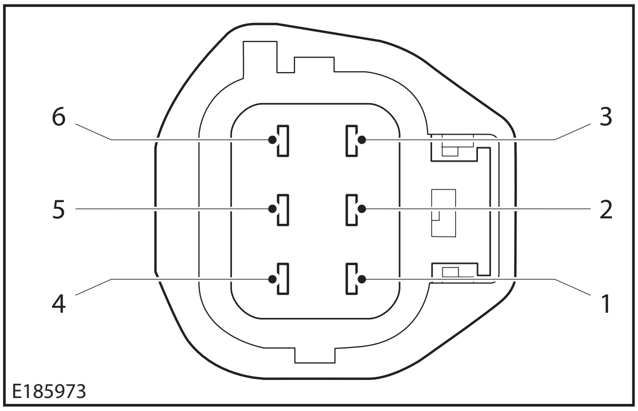
4.2.18 Trailer Tow Connectivity

Trailer Tow 7 Pin Socket



7 Pin Trailer Tow Connector	
Pin 1	Turn/Stop Lamp Left
Pin 2	Power Ground - To Chassis Point Off 13B576
Pin 3	Trailer Tow Brakes
Pin 4	Turn/Stop Lamp Right
Pin 5	Power Ignition ON
Pin 6	Park Lamps
Pin 7	Trailer Tow Back-Up Lamps

Trailer Tow Interface Connector In-line to 13B576



In-line to 13B576 (on harness 14406)	
Pin 1	Turn/Stop Lamp Left
Pin 2	Turn/Stop Lamp Right
Pin 3	Park Lamps
Pin 4	Trailer Tow Back-Up Lamps
Pin 5	Power Ignition ON
Pin 6	Trailer Tow Brakes

Trailer Position and Back-Up Lamps are by relay (not BCM). Position lamps R3 and Back-Up lamps R8 (in AJB).

Reverse Signal for aftermarket equipment such as backup alarms may be obtained at Pin 4, on the Trailer Tow 14406 in-line connector, see figure E185973. This circuit is fuse protected to 10 amps.

4.3 Communications Network

Electrical Architecture has been updated to MY24

4.3.1 CAN-Bus System Description and Interface

⚠ **WARNING: Do not tamper with, cut into or connect to any of the CAN-Bus interface wiring or connectors. The addition of unapproved CAN-Based modules could impact the safe operation of the vehicle.**

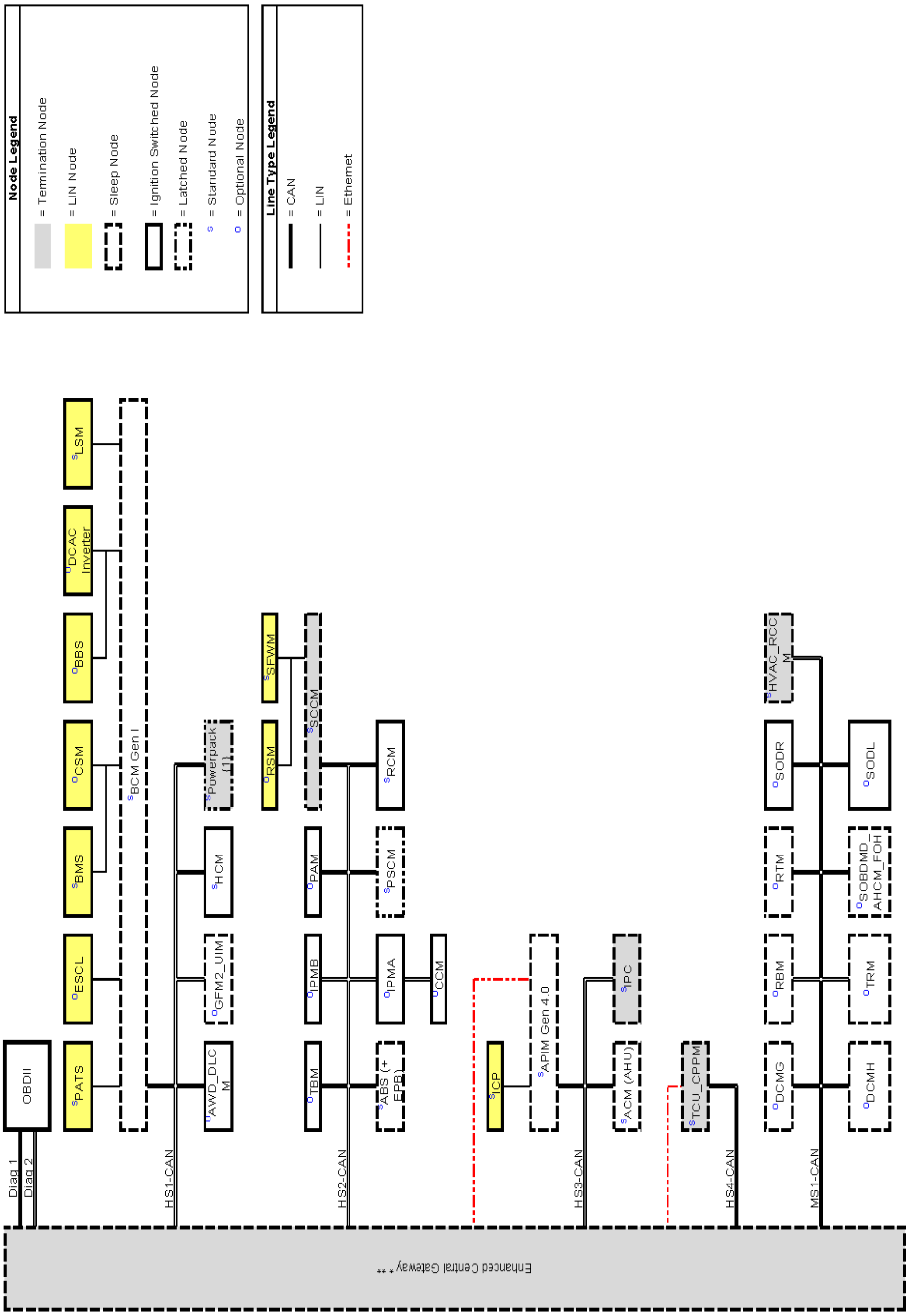
CAN, Controller Area Network, uses propriety message sets to communicate between the devices shown, via Medium Speed (MS), High Speed (HS), Private and Public Buses. In addition, there is localized application of Local Interconnect Network (LIN) and ISO 9141 K-line serial links.

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Communication Network System

Item	Description	Item	Description
ABS (+ EPB)	Brake Module with integrated Electric Park Brake	RCM	Restraints Control Module
ACM (AHU)	Radio	RSM	Rain Sensor Module (SCCM master)
APIM Gen 4.0	SYNC Gen 4.0	RTM	Radio Transceiver Module
AWD_DLCM	AWD Disconnect	SCCM	Steering Column Control Module
BBS	Battery Backed Sounder	SFWM	Smart Front Wiper Module (SCCM master)
BCM Gen I	Body Control Module Gen 1	SOBDMD_ AHCM_ FOH	Secondary OBD Control Module D - Aux Htr Ctrl Mod, Fuel Operated Heater
BMS	Battery Management System (BCM Gen 1)	SODL	Side Obstacle Detection, Left Side
CSM	Combined Sensor Module (BCM Gen 1)	SODR	Side Obstacle Detection, Right Side
DCAC Inverter	DCAC Inverter (BCM Gen 1)	TBM	Trailer Brake Module
DCMG	Door Control Module G (eLatch - Rear Left)	TCU_ CPPM	Telematics Control Unit
DCMH	Door Control Module H (eLatch - Rear Right)	TRM	Trailer Relay Module
ESCL	Electronic Steering Column Lock (BCM Gen 1)	SOBDM_ BCCM	Sec. OBD Ctrl Mod C - Batt Chrg Ctrl Mod (Gen IV)
GFM2_UIM	Upfitter's Interface Module	ECM_HEV	Engine Control Module for xEV (w PT Subnet)
HCM	Headlamp Control Module (Leveling)	CSI	Charge Status Indicator
HS1-CAN	HS1-CAN High Speed 1	SOBDMC_ HPCM	Sec OBD Ctrl Mod C - HEV P/T Ctrl Mod (Gen 4)
HS2-CAN	HS2-CAN High Speed 2	DCAC	Sec OBD Ctrl Mod C - HEV P/T Ctrl Mod (Gen 4)
HS3-CAN	HS3-CAN High Speed 3	ACCM	Air Conditioning Control Module (HV compressor)
HS4-CAN	HS4-CAN High Speed 4	BECM	Battery Electric Charging Module (Gen IV)
HVAC_RCCM	HVAC control module (standalone)	DCDC_ HEV	Battery Electric Charging Module (Gen IV)
ICP	Interface Control Panel (Sync master)	PACM	Pedestrian Alert Control Module
IPC	Instrument Panel Cluster	BCMC_ CPDB	CAN PDB
IPMA	Image Processing Module A (CCM/IPMA Integration)	AHCM_ PTC	Aux Heater Control Mod - PTC Heater (Gen IV)
IPMB	Image Processing Module B	PROP-VAL	Proportional valve for BEV hybrid
LSM	Light Switch Module (headlamps)	PUMP	Oil pump for HEV transaxle
MS1-CAN	MS1- CAN Medium Speed 1	DCAC Socket	120/240V outlet Socket
OBDII	On Board Diagnostics	GSM	Gear Shift Module (w/ PT subnet)
OBCC	Digital Communications Module	CCM	CCM/IPMA Integration
PAM	Park Aid Module (standalone, MNI)	TCU_ CPPM	Telematics Control Unit (FNV2 HS4)
PATS	Passive Anti-theft immobilizer (BCM Gen 1)	SOBDMC_ HPCM	Sec OBD Ctrl Mod C - HEV P/T Ctrl Mod (Gen 4)
PSCM	Electric Power Assist Steering	ECM_HEV	Engine Control Module for xEV (w PT Subnet)
RBM	Running Board Module		

CAN-Bus System, SYNC 4 (12” touch screen)

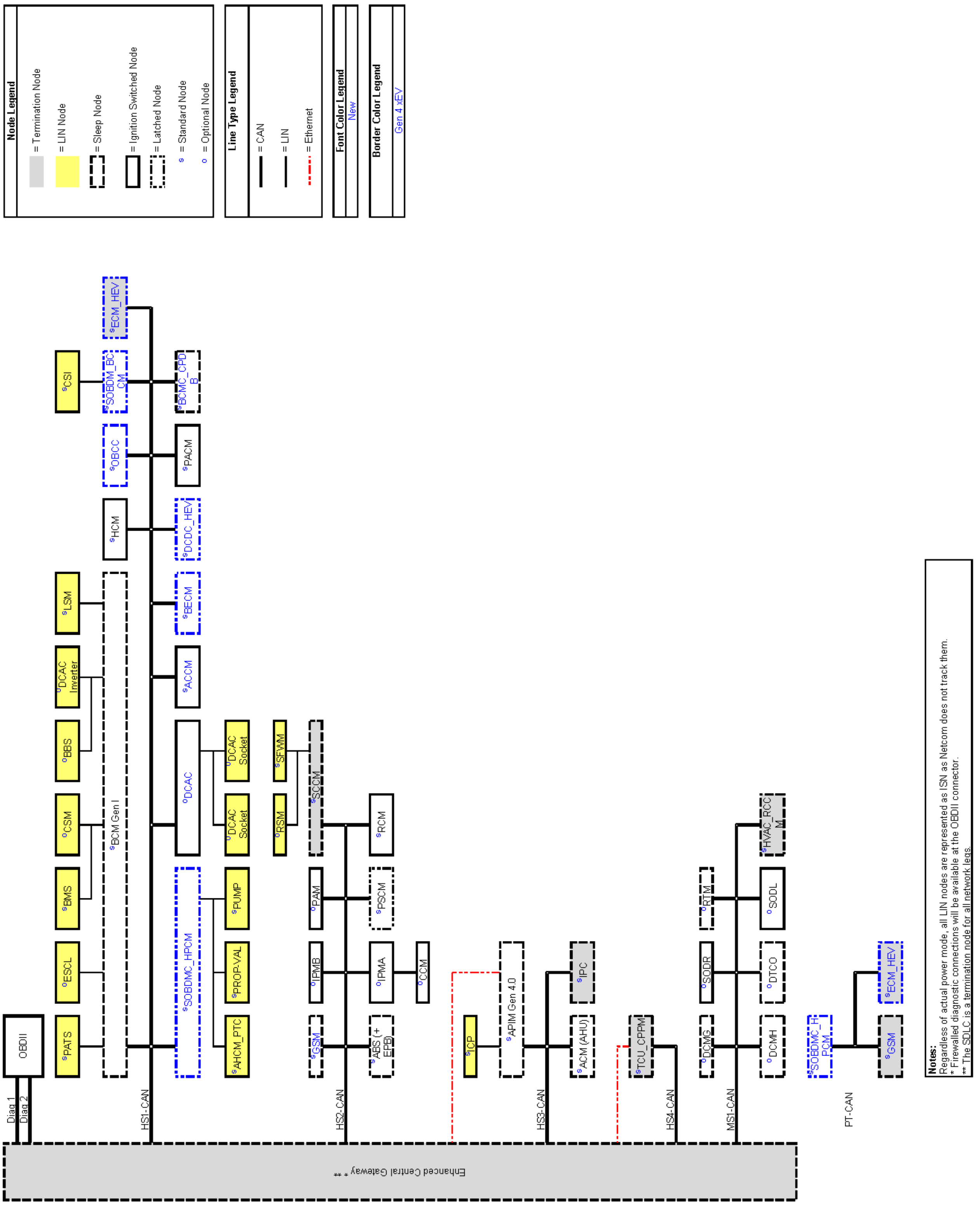

Node Legend
= Termination Node
= LIN Node
= Sleep Node
= Ignition Switched Node
= Latched Node
s = Standard Node
o = Optional Node
Line Type Legend
= CAN
= LIN
= Ethernet
OBDII
Diag 1
Diag 2
sPATS
oESCL
sBMS
oCSM
oBBS
oDCAC Inverter
sLSM
sBCM Gen I
HS1-CAN
oAWD_DLCM
oGFM2_UIM
sHCM
sPowerpack (1)
HS2-CAN
oTBM
oIPMB
oPAM
oRSM
sSCCM
sSFWM
sABS (+ EPB)
oIPMA
sPSCM
sRCM
oCCM
sICP
sAPIM Gen 4.0
HS3-CAN
sACM (AHU)
sIPC
sTCU_CPPM
HS4-CAN
MS1-CAN
oDCMG
oRBM
oRTM
oSODR
oHVAC_RCCM
oDCMH
oTRM
oSOBDMD_AHCM_FOH
oSODL
Enhanced Central Gateway * **

Notes:
Regardless of actual power mode, all LIN nodes are represented as ISN as Netcom does not track them.
* Firewalled diagnostic connections will be available at the OBDII connector.
** The SDLC is a termination node for all network legs.
1. See Powerpack tab for details

F40160

🟩 Abc = BEV Only 🟦 Abc = ICE Only

CAN-Bus System, eTransit BEV


Node Legend
= Termination Node
= LIN Node
= Sleep Node
= Ignition Switched Node
= Latched Node
s = Standard Node
o = Optional Node
Line Type Legend
= CAN
= LIN
= Ethernet
Font Color Legend
New
Border Color Legend
Gen 4 xEV
OBDII
Diag 1
Diag 2
HS1-CAN
PATS
ESCL
BMS
CSM
BBS
DCAC Inverter
LSM
CSI
BCM Gen I
HCM
OBCC
SOBDM_BCCM
ECM_HEV
SOBDMC_HPCM
DCAC
ACCM
BECM
DCDC_HEV
PACM
BCMC_CPDB
AHCM_PTC
PROP-VAL
PUMP
DCAC Socket
DCAC Socket
HS2-CAN
GSM
IPMB
PAM
SCCM
RSM
SFWM
ABS (+ EPB)
IPMA
PSCM
RCM
CCM
HS3-CAN
TCP
APIM Gen 4.0
ACM (AHU)
IPC
HS4-CAN
TCU_CPPM
MS1-CAN
DCMG
SODR
RTM
DCMH
DTCO
SODL
HVAC_RCCM
PT-CAN
SOBDMC_H-PCM
GSM
ECM_HEV
Enhanced Central Gateway * **

Notes:
Regardless of actual power mode, all LIN nodes are represented as ISN as Netcom does not track them.
* Firewalled diagnostic connections will be available at the OBDII connector.
** The SDLC is a termination node for all network legs.

F40161

4.3.2 Body Control Module (BCM)

WARNINGS:

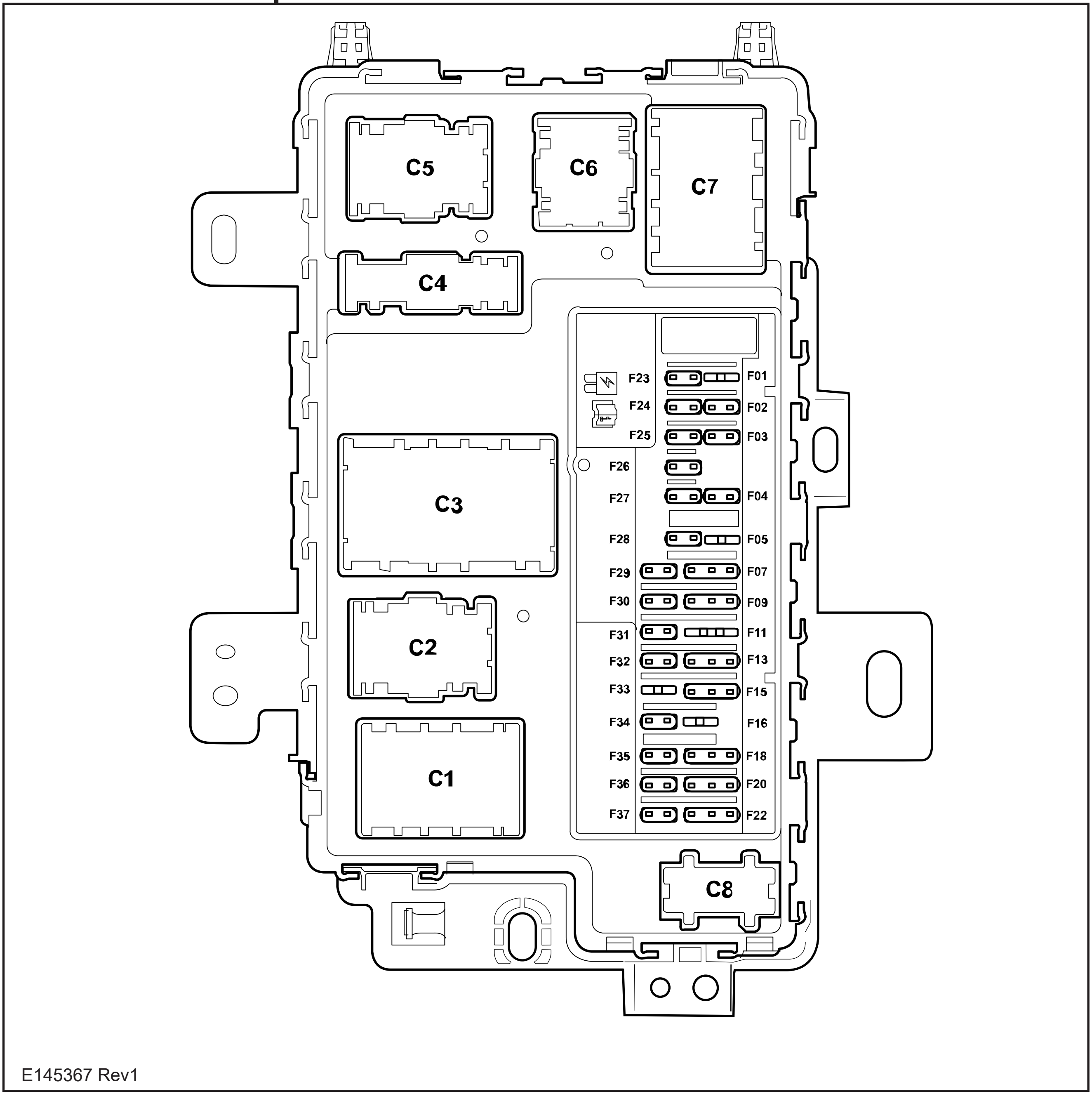
⚠ **Unapproved and/or incorrect connection to any of the mating wiring can cause either the associated systems to shut down (overload protection), or permanent damage to the BCM itself.**

⚠ **Vehicle BCM configuration must NOT be modified once the vehicle has left a Ford production plant, except for any changes that may be carried out using dealership integrated diagnostic systems equipment.**

The BCM is the prime control module in the vehicle's electrical architecture. It is responsible for management of most of the vehicle's lighting, locking and security systems.

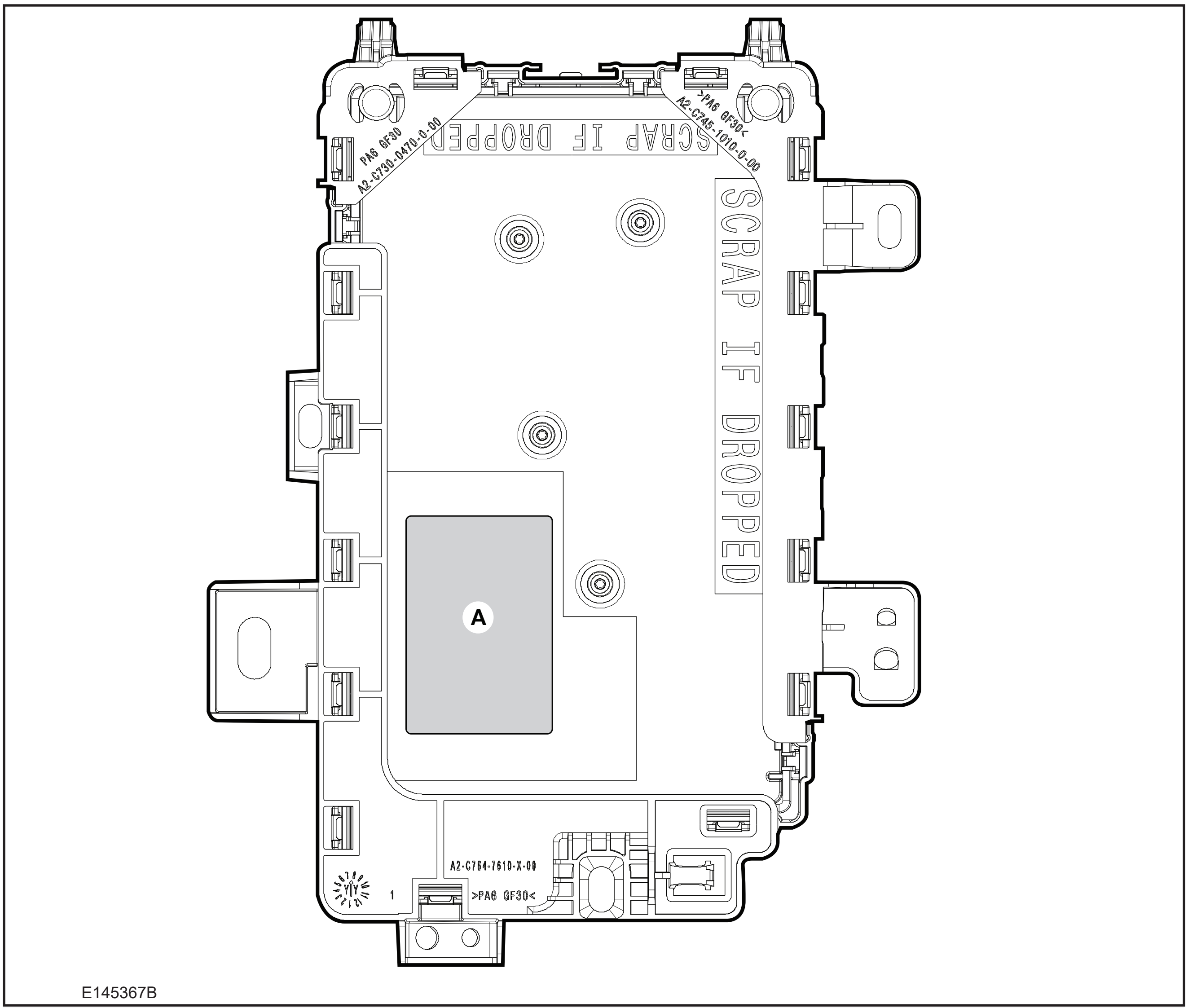
Repeated overloading of circuits can result in output lock-out requiring dealer reset. Repeated dealer resets can result in permanent loss of a function.

BCM - as viewed in-car position


C5
C6
C7
C4
F23
F01
F24
F02
F25
F03
F26
F27
F04
F28
F05
F29
F07
F30
F09
F31
F11
F32
F13
F33
F15
F34
F16
F35
F18
F36
F20
F37
F22
C3
C2
C1
C8
E145367 Rev1

🟩 Abc = BEV Only 🟦 Abc = ICE Only

BCM - rear view showing label position


SCRAP IF DROPPED
PA6 GF30
A2-C730-0470-0-00
>PA6 GF30<
A2-C745-1010-0-00
SCRAP IF DROPPED
A
A2-C764-7610-X-00
>PA6 GF30<
1
E145367B

Item	Description
A	Label Position

BCM Functionality

Functionality	
Dipped Beam	Delayed Accessory Power Supply
Main Beam	Engine Run Signal
Position Lamps	Reverse Lamps
License Plate	Front Fog Lamps
Brake Lamps	Park Brake Status
Daytime Running Lamps	Switch Back Light Illumination (dimming with headlamp switch fitted)
Direction Indicators and Hazard Lamps	Vehicle Horn
Courtesy Lamps	Brake Fluid Level
Tire Pressure Monitoring System	Washer Fluid Level Sensor
Battery Saver Timer	Brake Shift Interlock
Engine Immobilizer	Configurable Locking (set at time of order)
Power Door Locks	12V Power Point Control
Battery Management System	Ignition Status
IP Illumination Dimming	Automatic Headlamp Control
Perimeter Anti Theft Alarm	Door and Hood Ajar Status
Integrated Extendend Power for RCM	Configurable Locking - Config 7 Config 8 (set at time of order)

🟩 Abc = BEV Only 🟦 Abc = ICE Only

BCM Output Information

Function	Component	Load Type	Max. Load	Overload Condition
Dipped Beam Left/DRL (not HID)	High Side PWM for Bulb DC for HID Relay	Bulb/HID (via Relay)	55W	Output Shutdown(1)
Dipped Beam Right/DRL (not HID)	High Side PWM for Bulb DC for HID Relay	Bulb/HID (via Relay)	55W	Output Shutdown(1)
Main Beam Left	High Side PWM for bulb DC for HID Shutter	Bulb/ HID Shutter	55W	Output Shutdown
Main Beam Right	High Side PWM for bulb DC for HID Shutter	Bulb/ HID Shutter	55W	Output Shutdown
Daytime Running Light Left	High Side PWM (configurable for Smart LED DRL/ Position Light)	Bulb/Smart LED	30W	Output Shutdown
Daytime Running Light Right	High Side PWM (configurable for Smart LED DRL/ Position Light)	Bulb/Smart LED	30W	Output Shutdown
Position Light Left Front	High Side PWM	Bulb	15W	Output Shutdown
Position Light Left Rear	High Side PWM	Bulb	6W	Output Shutdown
Position Light Right Front	High Side PWM	Bulb	15W	Output Shutdown
Position Light Right Rear	High Side PWM	Bulb	6W	Output Shutdown
Front Fog Light Left	High Side PWM	Bulb	35W	Output Shutdown
Front Fog Light Right	High Side PWM	Bulb	35W	Output Shutdown
Turn Indicators Left Front	High Side PWM	Bulb	40W	Output Shutdown
Turn Indicators Left Rear(2)	High Side PWM	Bulb	40W	Output Shutdown
Turn Indicators Right Front	High Side PWM	Bulb	40W	Output Shutdown
Turn Indicators Right Rear(2)	High Side PWM	Bulb	40W	Output Shutdown
License Plate (& Marker Lights)	High Side PWM	Bulb/LED	60W	Output Shutdown
Reverse Lights	High Side DC	Bulb + Micro Relay	42W + 250mA	Output Shutdown
Stop/Turn Left	High Side PWM	Bulb	40W	Output Shutdown
Stop/Turn Right	High Side PWM	Bulb	40W	Output Shutdown
Center High Mounted Stop Light	High Side PWM	LED	1 x 16W or LED string	Output Shutdown
Switch Illumination	High Side PWM	LED	1.5A at 16V	Output Shutdown
Battery Saver Supply	High Side Driver	Bulb	75W	Output Shutdown
Front Cabin Lights Courtesy	High Side PWM	Bulb or LED	65W	Output Shutdown
Rear Cabin Lights Courtesy	High Side PWM	Bulb or LED	65W	Output Shutdown
Vehicle Horn	High Side Relay Driver	Micro Relay	250mA	Output Shutdown
Alarm Siren	High Side Driver	Electro Mechanical Sounder	4A nominal, 8A for 10ms in-rush	Output Shutdown
Engine Run Status	High Side Relay Driver	Micro Relay	250mA	Output Shutdown
Lock/Double Lock Outputs	Bi-directional Driver	Latch Motor (x 5 max)	6A per latch, 110ms Pulsed	Output Shutdown
Unlock Outputs	Bi-directional Driver	Latch Motor (x 5 max)	6A per latch, 110ms Pulsed	Output Shutdown

PWM = Pulse Width Modulation/DRL = Daytime Running Lights/HID = High Intensity Discharge

Repeated overloading of circuits can result in output lock-out requiring dealer reset. Repeated dealer resets can result in permanent loss of a function.

(1) BCM does NOT support HID directly Driven. HID MUST use relays.

(2) Available for Upfitter use - Bulb or LED Lamps.

Repeated overloading of circuits can result in output lock-out requiring dealer reset.
Repeated dealer resets can result in permanent loss of a function.

🟩 Abc = BEV Only 🟦 Abc = ICE Only

BCM Fuse Overview

Fuse	Rating	Fuse Type	Function
F2	10	Micro 2	Power inverter
F3	7.5	Micro 2	Power window switch and power exterior mirrors
F4	20	Micro 2	Not Used (Spare)
F6	10	Micro 3	Not Used (Spare)
F7	10	Micro 3	Not Used (Spare)
F8	5	Micro 3	Not Used (Spare)
F9	5	Micro 3	Interior sensor and rear air conditioning
F12	7.5	Micro 3	Climate control
F13	7.5	Micro 3	Steering column, instrument cluster and data link connector
F14	15	Micro 3	Battery energy control module - MHEV
F15	15	Micro 3	SYNC 3 module
F17	7.5	Micro 3	Not Used (Spare)
F18	7.5	Micro 3	Passenger airbag disable indicator and switch
F19	5	Micro 3	Not Used (Spare)
F20	5	Micro 3	Ignition switch
F21	5	Micro 3	PTC heater control
F22	5	Micro 3	Pedestrian alert control module
F23	30	Micro 2	Passenger door module
F24	30	Micro 2	Not Used (Spare)
F25	20	Micro 2	Not Used (Spare)
F26	30	Micro 2	Not Used (Spare)
F27	30	Micro 2	Not Used (Spare)
F28	30	Micro 2	Not Used (Spare)
F29	15	Micro 2	Not Used (Spare)
F30	5	Micro 2	Not Used (Spare)
F31	10	Micro 2	Data link connector and remote key receiver
F32	20	Micro 2	Radio and telematics module
F34	30	Micro 2	Ignition run/start relay pre fuse (park aid, heater control, LDW camera, restraints, central control panel, passenger airbag off indicator, tachograph, heater control, PTC heater, steering wheel module)
F35	5	Micro 2	Not Used (Spare)
F36	15	Micro 2	Park aid, lane departure warning camera, steering wheel module
F37	20	Micro 2	Not Used (Spare)
F38	30	Circuit Breaker	Power window supply

Any pins not listed in the table above are not to be used.
MHEV= Mild Hybrid Electric Vehicle; PTC= Positive Temperature Coefficient

4.4 LV Charging System (12V)

⚠ **WARNING: Do not cut into the alternator wires.**

NOTE: Alternator systems use Smart Regenerative Charging (SRC), please refer to this section.

NOTE: The alternator is LIN controlled. It does not have a conventional B+ (engine start) signal line.

NOTE: For further information please contact your National Sales Company representative or Local Ford Dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com

4.4.1 General Information

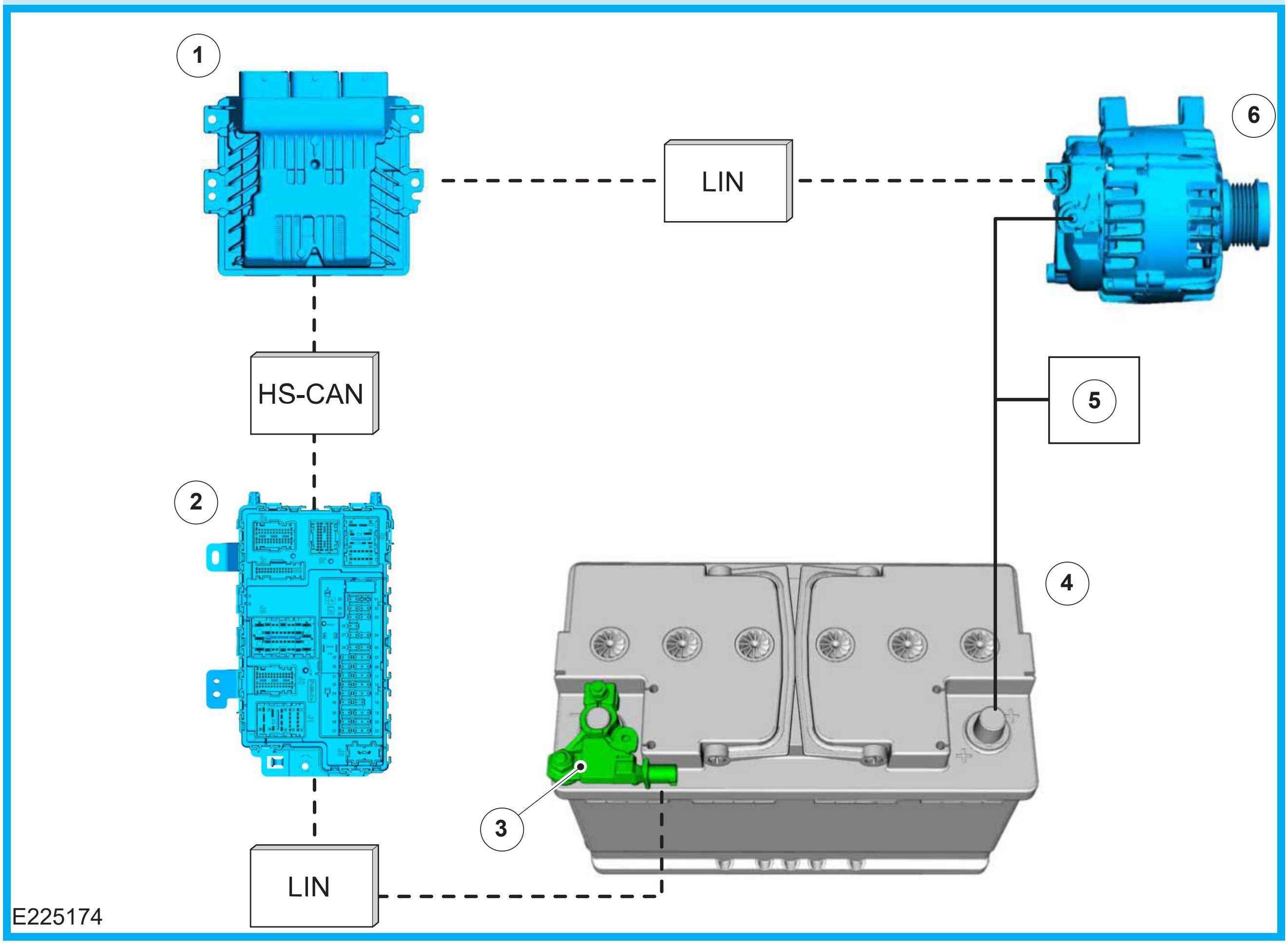
The battery capacity, technology and charge available from the alternator must be adequate to ensure engine cranking in unfavorable climatic conditions, even after fitment of additional electrical equipment.

Additional connection points are provided, specifically for customer use and are located on the outside of the driver's seat pedestal. A 60A fused connection is provided as standard on single battery vehicles. An additional 175A switched connection is provided for twin battery vehicles. Other options are possible for higher current applications,

Refer to: 4.5 Battery and Cables

4.4.2 System Layouts (Alternator-Based & BEV)

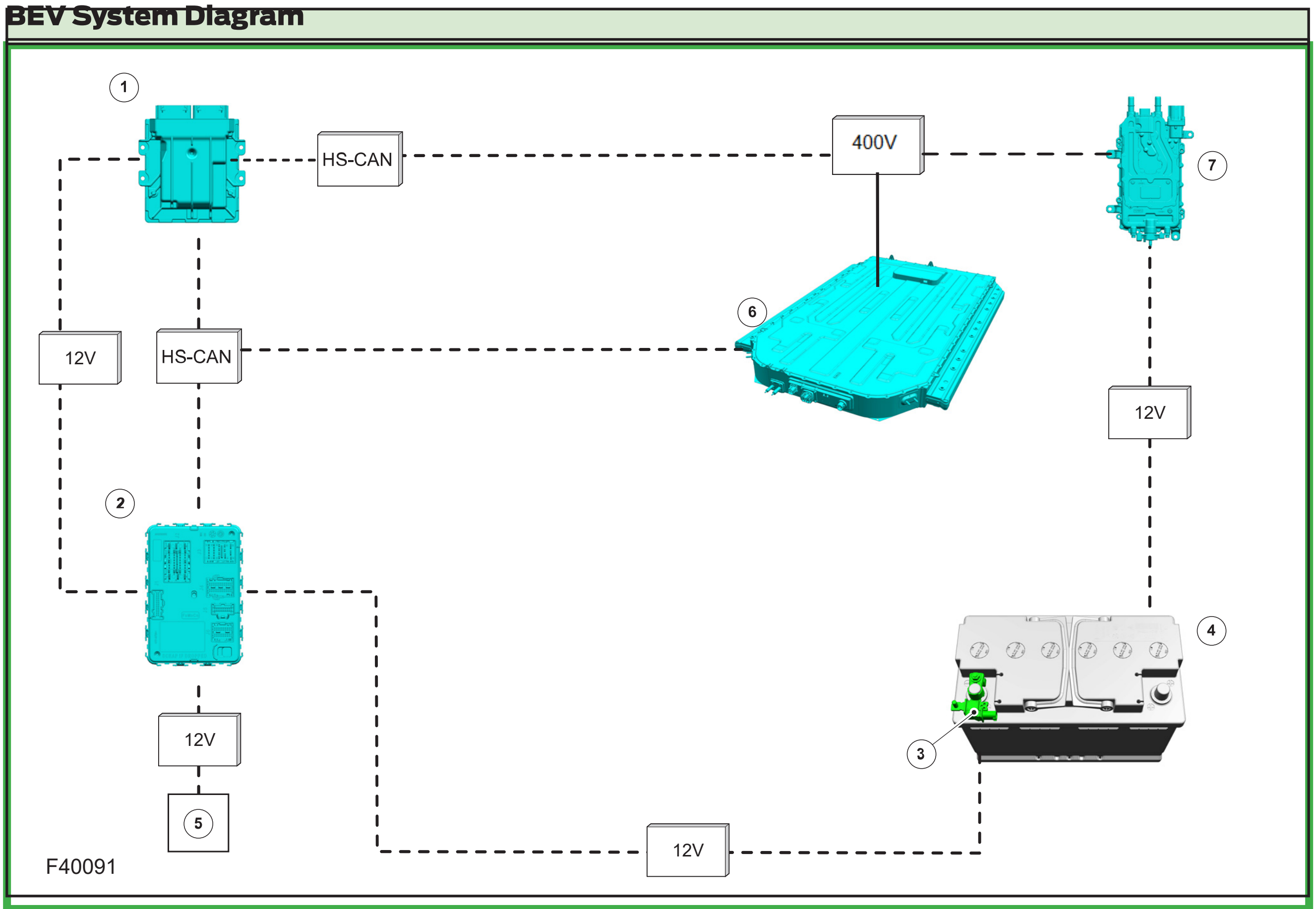
Alternator-Based System Diagram



Item	Description
1	Power Control Module (PCM) or Engine Control Module (ECM)
2	Body Control Module (BCM)
3	Battery Monitoring Sensor (BMS)
4	Battery — Twin batteries are available as an upgrade or driven by specific features
5	Electrical Consumers
6	Alternator

☐ Abc = BEV Only ☐ Abc = ICE Only

BEV System Diagram



Item	Description	Item	Description
1	Power Control Module (PCM) or Engine Control Module (ECM)	5	Electrical Consumers
2	Body Control Module (BCM)	6	High Voltage Battery
3	Battery Monitoring Sensor (BMS)	7	DC-DC Converter
4	Battery		

Summary of the Available Charging Modes

Charge Mode		Approximate Charging Voltages (Measured at Jump-Start post)
	Float mode/ Key on / On-plug charging	Minimum 12.2 - Maximum 14.9
SRC	Smart Regenerative Charging - normal charge mode.	Minimum 12.2 - Maximum 14.9
CC	Conventional Charging - applies a strong charging voltage until the battery is full and maintains alternator voltage above 13.5V unless battery temperature >40ºC. The actual voltage at the battery will vary depending on the alternator load.	Minimum 13.5 - Maximum 14.9

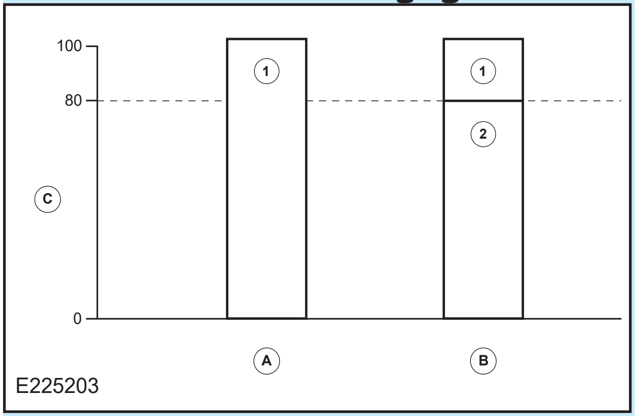
The voltages in the above table are approximate as the charging system is dynamic and can vary the voltage at any time. There is also a refresh mode that is activated periodically if the vehicle stands for more than 30 days. This may take the voltage to 15.2V.

4.4.3 Smart Regenerative Charging (SRC)

Smart Regenerative Charging varies alternator output using information from the Battery Monitoring Sensor to reduce fuel consumption. Alternator output can be increased during deceleration to charge the battery without the use of additional fuel. Alternator output can also be decreased to reduce the load on the engine and therefore fuel used. During this condition the battery supports the electrical loads. This function can be turned off by using Third Party High Power mode as detailed later in this section.

By comparison, Conventional Charging aims to charge the battery at a constant level which varies with battery temperature.

SRC and Conventional Charging



E225203

Item	Description
A	Conventional Charging
B	Smart Regenerative Charging (SRC)
C	Battery Charge Level (%)
1	Minimum 13.5V at battery when charging
2	Minimum 12.2V at battery when charging

4.4.4 SRC Override

SRC can be interrupted temporarily by Third Party High Power mode

4.4.5 Third Party High Power Mode

WARNINGS:

The Third Party High Power mode is a single method that has various effects. Do not allow the Third Party High Power mode to be active in incorrect conditions, as this may lead to unintended consequences. When implementing automated control of Third Party High Power mode, be sure to consider the full range of effects.

The Third Party High Power mode feature must not be grounded permanently. This will invalidate the emission and homologation of the vehicle. Permanently disabling the vehicle's fuel save features will require rehomologation as part of the approval process by the convertor.

The Third Party High Power mode can inhibit engine shutdown (AEIS) which is a safety procedure designed to protect against carbon monoxide (CO) poisoning. Do not operate the feature on a vehicle in a confined space. Do not install the feature on a vehicle that may be left running in a confined space. Do not allow carbon monoxide to accumulate.

When fitting automated systems to control Third Party High Power mode, be sure to record details within the owner's vehicle information. Advise subsequent owners of modifications relating to application of Third Party High Power mode. Subsequent owners of equipped vehicles are to be informed of applications of Third Party High Power mode.

CAUTION: Third Party High Power mode is only to be used where required for third party equipment functionality. When equipment is off and in a normal drive cycle. All fuel and emission save features must be active.

NOTE: When a vehicle is decommissioned for resale, the Third Party High Power mode inhibit needs to be removed from the vehicle.

Introduction

Third Party High Power mode has only one input that can affect the following features:

- SRC inhibit
- AEIS inhibit (feature restricted in some markets)
- At engine off, inhibit of the timer of the Standard Battery Guard (SBG)

Examples of when to not switch to third party mode include in a normal drive cycle when no extra loads are active. Solutions should only be used for heavy electrical loads, or mechanical power from the Front End Accessory Drive (FEAD), mainly when stationary.

The Third Party High Power mode is subject to configuration and may be subject to restriction.

AEIS Inhibit

This may be required to keep the engine running/vehicle-ready to drive when the vehicle is used for power generation, mechanical or electrical, in a stationary application. Normal AEIS functionality is where the engine/electric motor will automatically shutdown after 30 minutes if no driver input is detected.

SRC Inhibit (Conventional Charging)

When SRC is inhibited, such as by Third Party High Power mode, then the system is using Conventional Charging.

This may be required for converters requiring voltage in the range of 13.5V to 14.9V. Such applications include boost or supplemental battery charging, compensation for voltage drop or high ampere electrical loads whilst the engine is running.

For additional information Refer to: 4.6 Battery Protection Load-shedding.

Timer of Standard Battery Guard at Engine Off

This may be required to prevent the SBG operating too soon, when the engine is off.

Installation/Access

The Third Party High Power mode is activated by the grounding of a particular electrical circuit to a 'non permanent' switching strategy.

The Third Party High Power mode can be accessed at various vehicle connectors:

- As a kit to install the standard 10-way Vehicle Interface Connector in the driver's seat pedestal.
  - Interface Connector pin 3 available on all Non Camper variants.
- Pre-installed as part of a Camper Donor vehicle (C9)
  - 15-way camper connector pin 14
- Pre-installed as part of the High Specification Vehicle Interface Connector (A608).
-

A mating 43 way connector with three meters of wiring (with all wires) is available as a kit (KTBK2V-14A411-D*)from your local Ford dealer. For information on High Specification Vehicle Interface Connector , please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at BBAS@ford.com

- High Specification Interface Connector (A608) pin 24

For further information
Refer to: 4.6 Battery Protection
Refer to: 4.24 Electrical Connectors and Connections

4.4.6 Test Functionality

NOTE: There will be a delay between setting the Third Party High Power mode and the effect occurring (up to a 5 seconds delay).

NOTE: If the 12V SOC is already too low, the circuit will open before the timer to protect the engine start.

Test Functionality:

SRC Inhibit, Charging Mode Control

1. Ensure batteries have good charge. When charging, use the Jump Start point and engine bay ground point. Refer to the charging instructions in the Owner's Manual
2. Measure voltage between Jump Start point and engine bay ground point with engine running/ vehicle ready to drive and SRC inhibit input circuit open. Refer to the Roadside Emergencies section of the Owner's Manual
3. With the engine running/vehicle ready to drive, set to ground the circuit for Third Party High Power mode and measure battery voltage. The voltage should be in the ranges shown in the table 'Summary of the Available Charging Modes'. The voltage may depend on many factors including total electrical load, which loads are active, battery condition and others. The rate of charge between modes varies depending on which loads are active
4. Open the switch again and check voltage level returns to the original level measured in Step 2. SRC is active

Test Functionality: AEIS Inhibit, Idle Shutdown Control (where fitted)

1. Check that AEIS is fitted and operational
2. Set Third Party High Power mode
3. Check that the engine continues to run whilst the inhibit is set
4. Check that normal AEIS behavior resumes when the inhibit is not set, for example the engine shuts down after 30 minutes

Test Functionality: Inhibit of Timer for Engine Off Load-Shedding

1. Establish the preset timer of a SBG circuit e.g.
   - CCP2
   - Other switched ground circuits fed from the feature
2. Set Third Party High Power mode
3. Check that the circuit remains on after the timer period

Refer to: 4.6 Battery Protection

4.4.7 Charge Balance Guidelines

When fitting medium to high third party electrical loads, including extra batteries, a charge balance test should be performed. This includes all relevant Ford and third party loads active at the same time where the battery voltage should not go below 13V. This will ensure that the alternator is not damaged, extra batteries are charged and correct system functionality is maintained. SRC override is recommended to ensure the alternator is in full power mode. Increased performance can be achieved by elevating the idle, utilizing the engine RPM control option (A003).

4.4.8 Circuit Diagrams

For circuit diagrams for Auxiliary Fuse Panel connections and standard Ford relays.

Refer to: 4.24 Electrical Connectors and Connections
Refer to: 4.23 Fuses and Relays

Full vehicle wiring and circuit diagrams are in the Ford Workshop Manual.

4.4.9 Alternator Characteristics

NOTE: These alternator curves do not show spare output capacity as this would be dependent on original vehicle features and options.

NOTE: If the engine is running for long periods, assume the hotter temperatures apply.

The alternator performance curves show the Engine RPM speed control option (A003) and the factory set engine RPM values for mode 1. This data can be used for calculating charge balance values for the finished third party system.

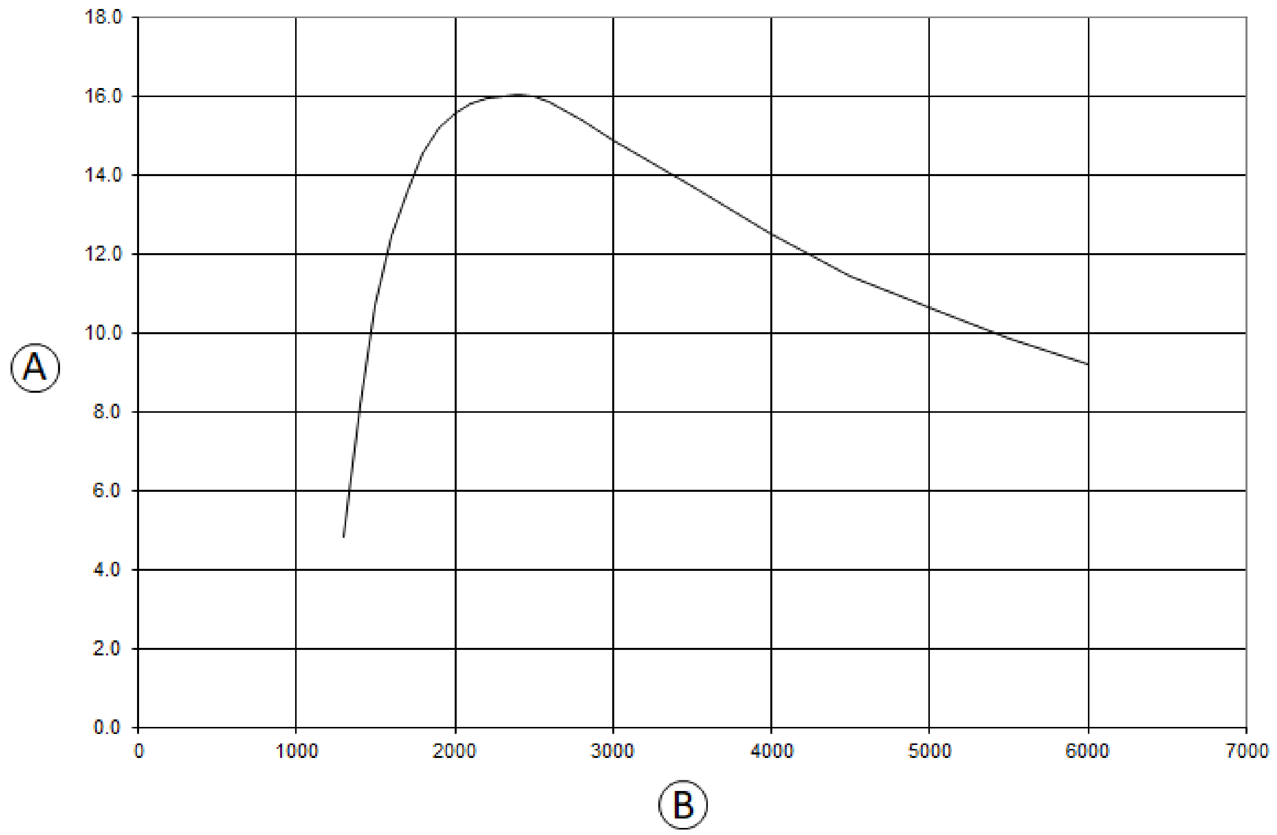
Refer to: 4.6 Battery Protection

Allow for the Ford system to require approximately 20A to run the engine. Any further Ford systems active such as blowers and lights, will further reduce available Ampere for third party systems. It is also recommended to utilize the SRC override feature

(Third Party High Power mode) to maximize alternator output. An overloaded alternator will exhibit voltage lowering below 12.8V and could lead to damage, so must be avoided.

NOTE: Dual alternator output and torque curves should be considered to be double that of the single alternator

Torque Curve of Alternator: Gasoline Engines



E284685B

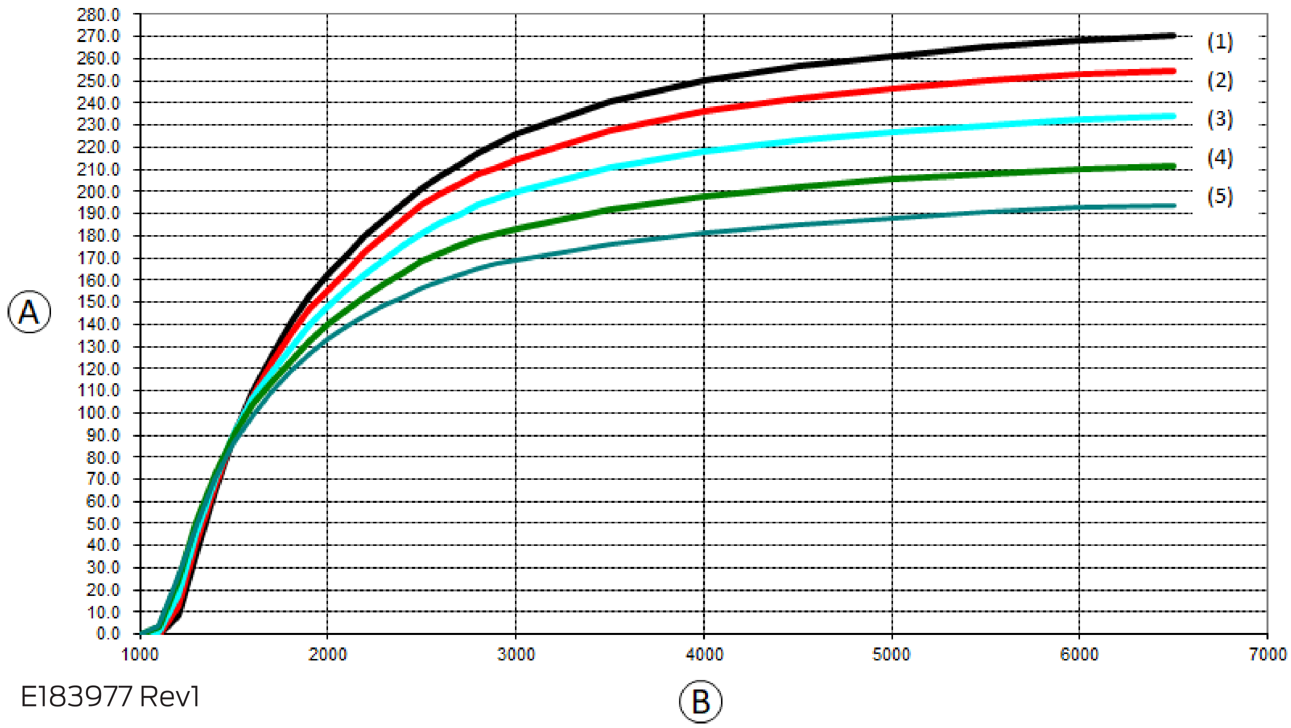
Item	Description
A	Torque (Nm)
B	Revolutions Per Minute (RPM)

Diagram E284685B shows the torque in Nm which is required to drive the alternator at full output. The vertical axis (A) shows the torque (Nm) and the horizontal axis (B) shows the alternator's revolutions per minute (RPM).

NOTE: For equivalent engine revs per minute (RPM), the alternators revolutions, axis (B) should be divided by the following factor: 2.7 for Gasoline Engines.

NOTE: Dual alternator output and torque curves should be considered to be double that of the single alternator

Output Performance of Alternator - Gasoline 250A Heavy Duty



E183977 Rev1

Item	Description
A	Output Current (Amps)
B	Alternator Speed (RPM)
1	Temperature 32ºF (0ºC) — Voltage 14.1V
2	Temperature 73.4ºF (23ºC) — Voltage 13.9V
3	Temperature 89.6ºF (60ºC) — Voltage 13.5V
4	Temperature 199.4ºF (93ºC) — Voltage 13.1V
5	Temperature 240.8ºF (116ºC) — Voltage 12.9V

Diagram E1183977 Rev1 shows the alternator output performance at five different temperatures In accordance to Ford specification. The vertical axis (A) shows output current (Amps) and the horizontal axis (B) shows Alternator speed in revolutions per minute (RPM).

NOTE: Dual alternator output and torque curves should be considered to be double that of the single alternator

4.5 Battery and Cables

WARNING: For electrical Power Take Off (PTO) that requires deep discharge and cycling from third party systems, High Performance Deep Cycle AGM batteries (HFQ or A739) must be ordered on the base vehicle. For more information, refer to 'Power and Connectivity Usage Recommendations' table later in the section. If option HFQ or A739 is not on the base vehicle they can be fitted by your local Ford Dealer. See table in Single and Twin Batteries Section.

CAUTION: Some batteries will require specific charging profile. Therefore you must use a suitable battery charger (e.g. DC-DC charger) for your selected battery. Please consult your battery supplier.

NOTE: If there is an isolation relay, check settings to ensure batteries are connected to the charging circuit.

NOTE: The battery capacity, technology and charge available from the charging system must be adequate to ensure engine cranking in unfavorable climatic conditions, even after fitment of additional electrical equipment.

NOTE: Auxiliary customer electrical loads exceeding 60A must be regulated by the Standard Battery Guard (SBG) and load-shedding system. For loads greater than 175A see 'Third Party +12V PTO for loads exceeding 175A' section in this BEMM.

NOTE: Do not make any additional connections to the Power Distribution Box (PDB) terminals, as over-torqueing could cause damage to the PDB. Any electrical loads should be taken from the CCP.

NOTE: For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com

4.5.1 Power and Connectivity Usage Recommendations

WARNING: If a third party battery guard is fitted, it must be connected to the load-shedding signal so that EPAS is protected in the event of an overload at engine run.

NOTE: Use Absorbent Glass Mat (AGM) batteries for deep cycle applications, i.e. charge and discharge on a regular basis.

NOTE: When considering battery discharge, the Vehicle Convertor needs to consider the current drawn when the added system is in operation, plus any continuous key off loads even when not in use. For example, an inverter fitted will consume power even with no load connected.

NOTE: Where possible, engine run operation of electrical equipment reduces battery discharge; both Vehicle Start and Auxiliary Batteries are utilized in conjunction with the charging system.

NOTE: User training and appropriate battery maintenance on a regular basis will assist in ensuring correct battery operation.

NOTE: For heavy 12V electrical demands at engine off/charging-off/DCDC-off situations, for example from 'beacons on for full working shift', then AGM technology battery/batteries are required. Standard 'Enhanced Flooded Batteries' are not suitable for routine use of High Voltage to low voltage charging system. Use 1 or 2 batteries according to the Power Usage table.

The section is to serve to assist with fitting the appropriately sized charging system.

Connectivity Usage	Recommended Specification (Feature code shown in brackets)
Additional fused relay outputs.	Auxiliary Fuse Panel (JZGAE)- option includes CCP2.
Additional switches.	Spare Accessory Switches - 4 (JZJAC) Note: Includes Auxillary Fuse Panel (JZGAE)

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Engine State	Power Usage	Recommended Specification (Feature code in brackets)
Engine Off Loads	**LOW CONTINUOUS PTO:** Up to additional 5mA Donor Vehicle Battery(s) at Key Off, for example: KL30 fed small current peripheral chargers.	Donor Vehicle Battery(s)
	MID CONTINUOUS PTO: Between 5mA and 30mA at Key Off, for example: Trackers (with sleep function, no GPS), Control Gear, KL30 fed medium current peripheral chargers.	Twin Batteries of same type (only standard on certain applications)
	HIGH CONTINUOUS PTO: Between 30mA and connection limit, for example: Trackers with GPS, Control Gear, KL30 fed high current peripheral chargers OR vehicles with multiple/extended activations of interior lighting, cycle locks and rear door ajar events. DO NOT EXCEED CONNECTION LIMIT.	Limited Engine Run/Charge cycles, 2 High Performance H6 Deep Cycle Absorbent Glass Mat (AGM) batteries (HTAAE). Frequent Engine Run/Charge cycles, 1 High Performance H6 Deep Cycle AGM battery (HTAAB). Where possible, connect loads to the Standard Battery Guard or Third Party Battery Guard. Refer to: 4.5 Battery and Cables for load-shedding.
	OCCASIONAL SHORT TERM HIGH PTO: Between 40A and 240A short term limit using twin battery energy, for example: Cranes, Tippers, Tail Lifts, 230V Inverters, Ambulances.	2 High Performance Deep Cycle AGM batteries (HTAAE). Additional batteries may be required, for further information see Battery Configuration, Additional Loads and SRC, in this section. Refer to: 4.5 Battery and Cables for Load-Shedding.
Engine Run Loads	**LOW CONTINUOUS PTO:** Up to 60A, for example: Maintenance Van with water heater and additional lighting but no further systems.	Single Donor Vehicle Alternator. CCP1 or other non-shed connection allowed. An SBG load-shed connection can also be used. Refer to: 4.5 Battery and Cables for more details.
	HIGH CONTINUOUS PTO: Up to single alternator limit, for example: Small Ambulance, Utility Vehicle. Refer to: 4.4 LV Charging System (12V) DO NOT ALLOW BATTERY DISCHARGE.	Single Donor Vehicle Alternator using Load-Shedding system: Up to 175A - CCP2 with twin-batteries, Up to alternator limit - load-shedding signal controlling Third Party disconnect hardware. Refer to: 4.5 Battery and Cables for more details. Use RPM Speed Control (A003) to enhance 12V charging, if required. For voltage support consider using Third Party High Power Mode. Note Non-sheddable load limit is 60A.
	VERY HIGH CONTINUOUS PTO: Up to twin alternator capability, for example large ambulance.	Twin Donor Vehicle Alternator using Load-Shedding system. Up to alternator limit -load-shedding signal controlling Third Party disconnect hardware. Refer to: 4.5 Battery and Cables for more details. Use RPM Speed Control (A003) to enhance 12V charging if required. For voltage support consider using Third Party High Power Mode. Non-sheddable load limit is 60A.
	PTO: Applications which require elevated engine idle speeds, for example: Mobile Tire Fitter Van, Welder's Vehicle and Mechanical PTO from engine.	RPM Speed Control.
	For applications where the Vehicle Convertor Load requirement exceeds HIGH CONTINUOUS PTO, for example: total Ford and Vehicle Convertor loads exceed the highest available Ford alternator rating.	High Power Pack option and supplemental batteries and supplemental energy source pending charge balance calculation.

4.5.2 High Current Supply and Ground Connections

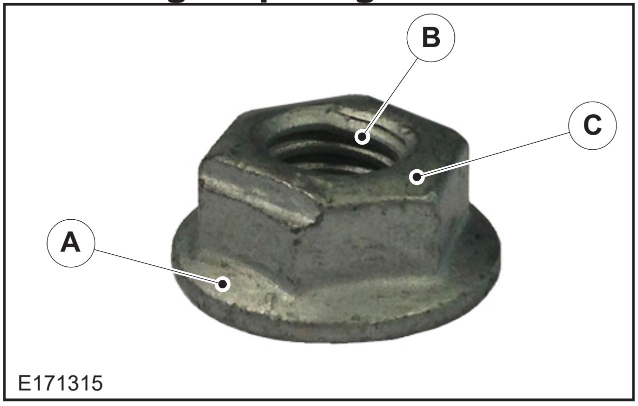
WARNINGS:

A self locking crimp hexagonal nut MUST be used for high current terminal stud connections, for battery positive and negative or chassis ground. Do not use locking, split washers or nylon lock type nuts.

It is recommended to only use one eyelet per stud for high current applications. If more than one eyelet per stud is unavoidable, the highest current eyelet feed should be connected closest to the supply terminal. Do not exceed two eyelets or crimp terminals per stud connection.

For additional information
Refer to: 4.24.4 Customer Connection Points

Self-Locking Crimp Hexagonal Nut



Item	Description
A	Large flange for maximum surface area current flow and large clamp force area.
B	Crimp / locking feature is obtained by deformed female thread only
C	Finish must be a low resistance material which complies with the Restricted Substance Management Standards (RSMS).

4.5.3 Guidelines When Converting Vehicles

Responsibilities and Considerations

WARNING: The fitting of voltage boosters or other devices to enhance alternator output is not allowed. The fitting of such devices will not only invalidate vehicle warranty, but could damage either or both, the alternator and Engine Management System/Power Control Module, and possibly affect vehicle legal compliance. Check local legislation.

Operator requirements for additional and specialized electrical equipment vary. The Vehicle Convertor must therefore consider the following points when designing the installation:

- Maintain legality and regulatory conformity of the base vehicle
- Driveability and serviceability of the base vehicle
- The effect of regulations governing the proposed conversion including national legislation in the country of sale
- The method of integrating the circuit into the base vehicle
- The materials and installation must meet the quality standards described in this section

Normal Operating Voltage

The Transit electrical system is charged by one, sometimes two, alternators. The vehicle electronics run on a 12V supply with a negative ground return. The factory fit equipment is designed for normal operations to be fully operational in the range 9-14V.

Voltage Check and Charging Procedure

WARNING: Do not connect to any ground or +12V potential points other than that specified in the Owner's Manual. There is a dedicated charge point under the hood. Failure to comply may lead to high current paths that may damage peripherals and electronic modules, especially in a Jump Start condition.

All voltages are to be measured with an accuracy of ±5% of values published, using calibrated meters. Measure the voltage by using the CCP1 or the battery plus terminal for positive connection and battery ground or battery minus terminal for negative connection.

1. Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm up to at least 41ºF (5ºC) before charging. This may require four to eight hours at room temperature depending on the initial temperature and battery size.
2. A battery which has been completely discharged may be slow to accept a charge initially, and in some cases may not accept a charge at the normal charger setting. When batteries are in this condition, charging can be started by use of the dead battery switch or boost charge on chargers that have this facility.
3. To determine whether a battery is accepting a charge, follow the manufacturer's instructions for the charger, for use of the discharged battery/ boost charge mode.

Surface Charge Dissipation

Prior to carrying out manual voltage checks, it is necessary to establish that the battery does not have any damage and the battery voltage is stable and free from surface charge which occurs after engine run. To ensure surface charge is not present, measure the battery voltage after the vehicle has been standing with the ignition off and no loads active for a prolonged period of 24 hours. If this is not possible an estimate can be made using the following method:

1. To dissipate whatever surface charge is present in the battery turn on the headlamps (main beam) for 5 seconds or turn on the parking lamps for 15 seconds if the head lamps will not turn on with the key in the off position.
2. Turn off the lights and allow the key off loads to reach their steady value. This typically takes 10-15 minutes.

Sensitivity and Voltage Tolerance

The Transit utilizes multiplexed vehicle electronics. It is recommended that the appropriate Ford proprietary accessory systems are used. Inappropriate or incorrect connection of additional equipment could cause misoperation, or damage to the vehicle, and so invalidate any warranty.

Stored and Delayed Vehicles

Vehicles held at the Vehicle Convertor premises and/or not in use for longer than 7 days, should have the battery's negative cable disconnected. Before shipping to the customer, the battery negative cable must be reconnected and the voltage rechecked. A complete recharge is required for battery voltage below 12.4V for standard and enhanced flooded or 12.3V for AGM or for no-crank vehicles by using an appropriate charger.

For additional information
Refer to: 1.9 Vehicle Transportation Aids and Vehicle Storage

Transport Mode

⚠ **WARNING: The only method to return the vehicle to Transport mode is by using a Ford diagnostic service tool with the correct level of security clearance. The Ford dealer has the correct tools and level of security to do this if required.**

If the cluster displays 'Transport Mode', the vehicle may have reduced functionality. This mode is mainly to conserve battery life/warranty during pre-delivery.

To change mode, the brake pedal must be depressed five times, and the hazard warning switch operated twice (in any combination) within a 10 second period.

The SBG, CCP2 and third party load-shedding system is 'always off' during Transport mode.

Power Disconnection

⚠ **WARNING: Disconnection is required for welding work and work with airbags. Disconnect all the batteries, including ground and insulate the negative battery terminal(s).**

NOTE: After disconnecting the power supply and before performing further work, a wait time of 15 minutes must be maintained to ensure safety systems are fully deactivated.

Following battery disconnection, there is no need to reprogram the vehicle. It retains its normal power management settings and configurations. However, the central locking latches may cycle if one of these was opened manually in the intervening period. With regard to the radio, all of the settings are retained.

There is no longer a need to reprogram the electronic security code, as it is tied into the VIN of the factory fit Transit system. The clock initializes to 12:00 and will need to be reset to the correct time in accordance with the customer handbook procedure.

Ground Connections

NOTE: If there is a battery guard or an isolation relay, check settings to ensure batteries are connected to the charging circuit.

High electrical loads should also be grounded directly to the vehicle body and not the negative battery terminal. Connecting to the negative battery terminal will bypass the BMS and affect the correct assessment of the battery state of charge. Refer to BMS section in this manual.

Refer to: 4.6 Battery Protection

If separate charging systems are added, the ground side of the charger must also be connected to the body. An auxiliary ground stud eyelet can be ordered: part numbers KU5T-14436-B** for single battery and standard with A739 option or jumper cable KK2V-14301-K* for twin battery systems.

Refer to: 4.24 Electrical Connectors and Connections

This will be standard when pre-ordered with Regular Production Order for Auxiliary Fuse Panel (JZGAE), Spare Accessory Switches - 4 (JZJAC) and 2 High Performance H6 Deep Cycle Absorbent Glass Mat (AGM) batteries (HTAAE). .

Battery Cable Fixing Torque

The battery cables should be fixed to the terminal post with a torque of 5.9 ft lb (8.0Nm) ± 0.89 ft lb (1.2Nm) for positive or negative battery post connection with/without BMS. For additional information, see BMS later in this section.

Battery Safety

WARNINGS:

⚠ **Take necessary safety precautions when handling batteries, for example: protective clothing, eye and hand protection.**

⚠ **Ensure batteries are charged in a designated charging area that is correctly ventilated.**

⚠ **Make sure that the battery box is correctly sealed including any additional cables routing in and out of the box. After**

conversion, always check that the drain tubes have not been dislodged.

Battery Type and Capacity

NOTE: If a Vehicle Convertor intends to add systems or accessories that will add load at key off or engine run, then twin batteries should be specified, in particular, AGM battery type. There are also alternator upgrades and other options that are needed for PTO requirements. Refer to the table 'Power and Connectivity Usage Recommendations' in this section of the BEMM for your vehicle.

The base vehicle is equipped with either a single or twin battery system.

The vehicle may have Standard Flooded, Enhanced Flooded or AGM batteries as factory fit. Higher capacity batteries are available as standard production options and Special Vehicle Options offer AGM technology for heavy PTO and deep cycling applications. Before installing additional electrical equipment check that the battery capacity, technology type, harness load capability and charging system output are suitable for the extra load.

Refer to: 4.5.1 Power Connectivity and Usage Recommendations Power and Connectivity Usage Recommendations table.

The battery capacity, technology and charge available from the charging system must be adequate to ensure engine cranking in unfavorable climatic conditions, even after fitment of additional electrical equipment.

Battery Box

⚠ **WARNING: It is important that the battery box, vent tube and lid must be replaced after conversion from standard to AGM battery(s). If the battery lid/cover is missing or damaged, a replacement part must be ordered and fitted. It is recommended to check fitment as part of a quality control process. See figure E278335 Rev1 in the BMS later in this section of the BEMM.**

Battery Drain Prevention

As part of the Vehicle Convertor process and to maximize battery life and prevent premature failure of the Ford batteries, protect and prevent battery discharge during any conversion or whilst the vehicle is in storage. This may include leaving the vehicle in Transport mode as long as possible, reducing the amount of crank cycling around the facility, door ajar events and duration. It is recommended to check voltage when receiving and before shipping. Recharge with an appropriate proprietary battery charger if the vehicle battery voltage is below 12.4V for Standard and Enhanced flooded or 12.3V for AGM. Measure connected to the vehicle at ignition off and no loads active including interior or exterior lights in Off status.

Battery Rest Period

After reconnecting, the BMS requires at least 4 hours quiescent period to recalibrate to the correct battery state of charge, see also BMS information later in this section.

Usage of Electrical Loads During Conversion

If electric loads are used during conversion, for example multiple crank cycles or door ajar, check the battery voltage more frequently than every 7 days and recharge the battery if necessary.

For additional information
Refer to: 1.9 Vehicle Transportation Aids and Vehicle Storage

Engine Off Loads

All loads that exceed 100mA continuous key off load require an isolation switch or disconnected relay. In general, all loads should have some form of isolation. A supplemental battery may be required to power systems, for example: GPS vehicle tracking systems that pull high key off loads continuously. This is to protect from discharging batteries at ignition off and interfering with the BMS correlation of battery state of charge. This supply should also have a dedicated protection fuse of the correct value.

Refer to: 4.6 Battery Protection

Jump Start

Do not Jump Start the vehicle directly from the battery. Use designated Jump Start points. Refer to the Owner's Manual. The wiper motor bracket must not be used as a ground as it is isolated from the body.

Customer Connection Points (CCP) and Other PTO Locations

Any peripherals added to the power supply must be either connected in one of the following ways:

- Up to 60A - across CCP1 and Camper 60A supply
- Up to 175A - CCP2 with twin-batteries
- Up to local fuse - Auxiliary Fuse Panel JZGAE)
- Up to alternator limit - direct from battery, when controlled using load-shed signal and Third party switch

For loads greater than 175A (CCP2), up to 240A can be connected from the battery cable for short term use, less than 2 minutes.

Refer to: 4.5 Battery and Cables

Auxiliary Electrical Systems

NOTE: When auxiliary electrical systems are to be added to the vehicle, it is mandatory that the additional circuit design includes the necessary fuses. The Auxiliary Fuse Panel is recommended.

When auxiliary electrical systems are added to the vehicle, it is recommended that the additional circuits are designed to be used with the Auxiliary Fuse Panel to maintain the integrity of the electrical system

Refer to: 4.23 Fuses and Relays

The materials and installation must meet the quality standards described in this section. Any additional equipment or components must be designed such that they have no adverse Electro Magnetic Compatibility (EMC) effect on the vehicle.

Third Party High Power Mode

Third Party High Power mode is a Ford function that is available to assist with third party electrical and mechanical PTO. This will allow power for longer at engine off and help sustain a higher voltage during engine run. This mode includes SRC Inhibit and engine off load-shedding timer override.

Cable Routing

Take special care with the routing of existing electrical harnesses within the vehicle, to avoid damage when fitting additional equipment. Also, see section concerning installation of equipment containing an electric motor.

Fitting Equipment Containing Inductive Loads

⚠ **WARNING: When inductive loads, such as electric motors, are to be fitted consideration of inrush current is needed.**

❗ **CAUTION: The following must be observed:**

- All inductive loads must be driven via relays with contacts rated at least 3 times the maximum rated current of the motor
- All inductive loads supply circuits must be individually fused with the proper fuse rating for the motor
- All power wiring must be rated for at least 3 times the rating of the motor and installed as far away as possible from any existing vehicle wiring
- All inductive loads fitted should be fully suppressed to European or applicable local Legislation relating to EMC to ensure electrical interference does not affect the vehicle systems
- Add EMC emissions statement to CE approval

Airbags

NOTE: After disconnecting the power supply and before performing further work, a wait time of up to 15 minutes must be maintained. Work on airbag systems may only be performed by persons who have a relevant certificate of competence.

Pay attention to the following points:

- Disconnect all the batteries, including ground and insulate the negative battery terminal(s)
- Disconnect the electrical connector at the airbag control module

Welding and Cutting

Increased use of comfort and safety electronics in modern motor vehicles also requires the greatest attention to be paid during body work. Over voltages produced during welding and in alignment work during body shell rectification may cause electronic systems to be damaged. In particular, the safety instructions for performing welding/cutting work on vehicles with airbag systems must be adhered to.

For additional information on welding

Refer to: 5.1 Body

Pay attention to the following points:

- Disconnect the alternator multi-plug prior to using welding or cutting equipment
- If welding or cutting is to be performed directly near a control module, it must be removed beforehand
- Never connect the negative cable of the welder near an airbag or a control module
- Connect the negative cable of the welder close to the location of the weld

4.5.4 Battery Options

NOTE: If wrong batteries or incorrect configuration, SRC may not function correctly.

Any additional or different batteries must be checked for correct functionality on SRC vehicles.

Refer to: 4.10 Electronic Engine Controls SRC
Refer to: 4.4 LV Charging System (12V)

4.5.5 Battery Rules

NOTE: When modifying the battery pack it is recommended to also update the vehicle configuration.

NOTE: Charge balance calculations are required when adding additional systems, taking into account charging system capacity and battery capacity.

- Batteries in parallel must be of the same type and capacity and listed in the Ford battery table
- Third party batteries and loads are to be isolated from the standard Ford system at key off or by a Ford or third party battery guard system
- For external charging of batteries, ensure that the maximum voltage of 15.2V is not exceeded. Normal proprietary charging equipment should operate below this voltage

Where twin batteries are required on vehicles with a single battery installation, associated wiring and hardware should be fitted and aligned to Ford architecture. The extra battery must be of the same technology and performance rating as the existing battery. Alternatively, battery systems can be upgraded to the High Performance Deep Cycle AGM

Battery Type and Usage

Battery Part Number	Type	Quantity	Size
Single Battery - Deep Cycle AGM Battery Configuration B			
USZ1T-10655-AA	760 CCA (70Ah @ 20 hour rate) Absorbent Glass Mat Battery	1	H6
Twin Batteries - High Performance Deep Cycle AGM Battery Configuration C			
USZ1T-10655-AA	760 CCA (70Ah @ 20 hour rate) Absorbent Glass Mat Battery	2	H6

batteries: twin (HTAAE) or single (HTAAB) system.

If the battery type on a vehicle is changed to other compatible derivatives (see battery configuration table) it is required to reconfigure the vehicle to the new battery types from the dealer.

For special conversions requiring a third party battery, a further disconnect strategy is required. This should be controlled via the engine run signal to a normally open relay. A schematic of this architecture can be found later in this section.

Refer to: 4.4 LV Charging System (12V)

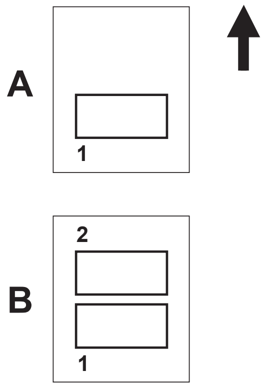
The load a battery could add to the vehicle when requiring a charge, may exceed 60A. If third party loads are also connected, a relay or contactor, controlled by the load-shedding signal, must be used to isolate.

Important Factors for Battery Choice

- Battery specification capability in ampere hours for continuously loading until empty. For example an 80Ah fully charged battery can supply 4A over a 20 hour period at 68ºF (20ºC) until it is fully discharged
- The Cold Crank Ampere (CCA) rating is the maximum rating for cold start requirements
- For deep cycling and micro cycling requirements (engine off loads) the deep cycle battery system is recommended. For high power (twin system) requirements at engine off use, use twin AGM

Extra batteries added to the power supply should be connected as shown at the end of this section.

4.5.6 Battery Configurations



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Item	Description
1	Main Battery
2	Auxiliary Battery
A	Single AGM Battery System
B	Twin AGM Battery System

Additional Loads and SRC

NOTE: The following battery configurations are NOT compatible with SRC

SRC will operate within specification only if a correct battery configuration is installed in the vehicle. SRC system functionality cannot be guaranteed with the following configurations.

- Mixed sizes
- Battery types other than those listed in the Battery Type and Usage table
- Extra batteries than factory fit - for example: 3 or more, if not isolated from existing power supply at key off
- If twin Ford battery configured, only fitting single Ford battery
- If single Ford battery configured, fitting twin Ford battery

It will not be possible to decommission the SRC feature due to homologation, vehicle tax and excise requirements.
If the battery type on a vehicle with SRC is changed to other compatible derivatives (see battery

configuration table) it is required to reconfigure the vehicle to the new battery types at your local Ford dealer.

The feature content of the vehicle must still remain an SRC vehicle to be in line with the homologation, vehicle tax and excise requirements.

4.5.7 Convertor Fit Additional Third Party Batteries

WARNING: For any third party power connections needing greater than 60A when CCP2 is not used, all connections must be controlled via either the load-shedding signal. There must not be any exceptions to this conversion strategy, as the signal is to protect the Ford power supply from overload and voltage drop that can affect critical systems. It is not recommended to use the 60A CCP1, Camper, High Specification Interface Connector feed to supply a third party battery.

NOTE: It is the Vehicle Convertor's responsibility to ensure the power supply on the vehicle is adequate to supply both Ford and third party systems, especially if they can be active at the same time. System voltage at engine run must not fall below 13.0V whilst the vehicle is in motion and if Third Party High Power mode is active.

The assumption is that greater than 60A would be required for camper vehicles and any other conversions requiring an additional battery. Therefore, isolation should be provided by either the 175A Customer Connection Point (CCP2) or a third party relay or contactor controlled by the load-shedding signal. In all systems, there is engine off power protection, providing enough remaining energy for a future engine start. Suitable capacity in the wiring, fuses and energy sources must be calculated. The extra battery, when discharged, becomes a load that can be up to 100A, so adds to the energy requirement from the charging sources, along with the third party loads.

Refer to: 4.6 Battery Protection

If additional batteries are added, these should be connected via a disconnect mechanism, such as CCP2, or another battery guard controlled by the load-shedding signal. If the third party battery and added system requirements exceed 175A (CCP2) of current, connection to the battery positive 6mm stud is permissible only when integrated with the load-shedding signal. Refer to the 'Third Party +12V PTO for Loads Exceeding 175A' in this section. For example of convertor fit third party battery installation to existing Ford power supply architecture see figure E289272 in this section.

If supplemental chargers are to be used, they must be connected directly to the third party battery.

The charge can also be applied to the Ford fit batteries, all relays/switches connected, but only for an emergency charge.

When changing from an incompatible battery configuration to a compatible system, SRC/SC (MHEV) functionality will take some time (ignition off overnight and multiple ignition run cycles) to re-establish full functionality.

Refer to: 4.4 LV Charging System (12V) System Operation

Third Party +12V PTO for Loads Exceeding 175A

WARNINGS:

DO NOT connect the same load to both CCP1 and CCP2. The system is not designed to work together as the fuses have different values.

It is important that the battery box lid/cover are replaced after any conversions to the battery positive terminal. See figure E278335 Rev1 in the BMS later in this section of the BEMM. If the battery lid/cover is missing or damaged, a replacement part must be ordered and fitted. It is recommended to check fitment as part of a quality control process after a conversion.

Third party +12V PTO connectivity should be made to the CCP, where possible. In the event a current requirement greater than 175A but less than 250A peak loading (maximum fuse value third party installed), connecting to the rear battery +12V clamp 6mm stud is permitted in conjunction with a disconnect relay controlled by the load-shedding signal. A twin battery system is recommended for this application.

Refer to: 4.6 Battery Protection

The following fusing principles must apply:

- For a long duration (greater than one hour continuous), the fuse must be no higher rating than the alternator fitted to the vehicle
- For short term loads such as one minute peak loads, a 250A fused cable can be installed. Conversion examples: Crane, Tipper, Tail-Lift

This is only allowed if testing by the Vehicle Convertor confirms that there are no issues (documentation must be held to confirm the tests) and the following criteria is met:

- No movement before full tightening of the nut (no risk of rotation). The third party eyelet must be a tight fit within the battery clamp slot and have a maximum Cross Sectional Area (CSA) for current flow
- The cable CSA must be oversized

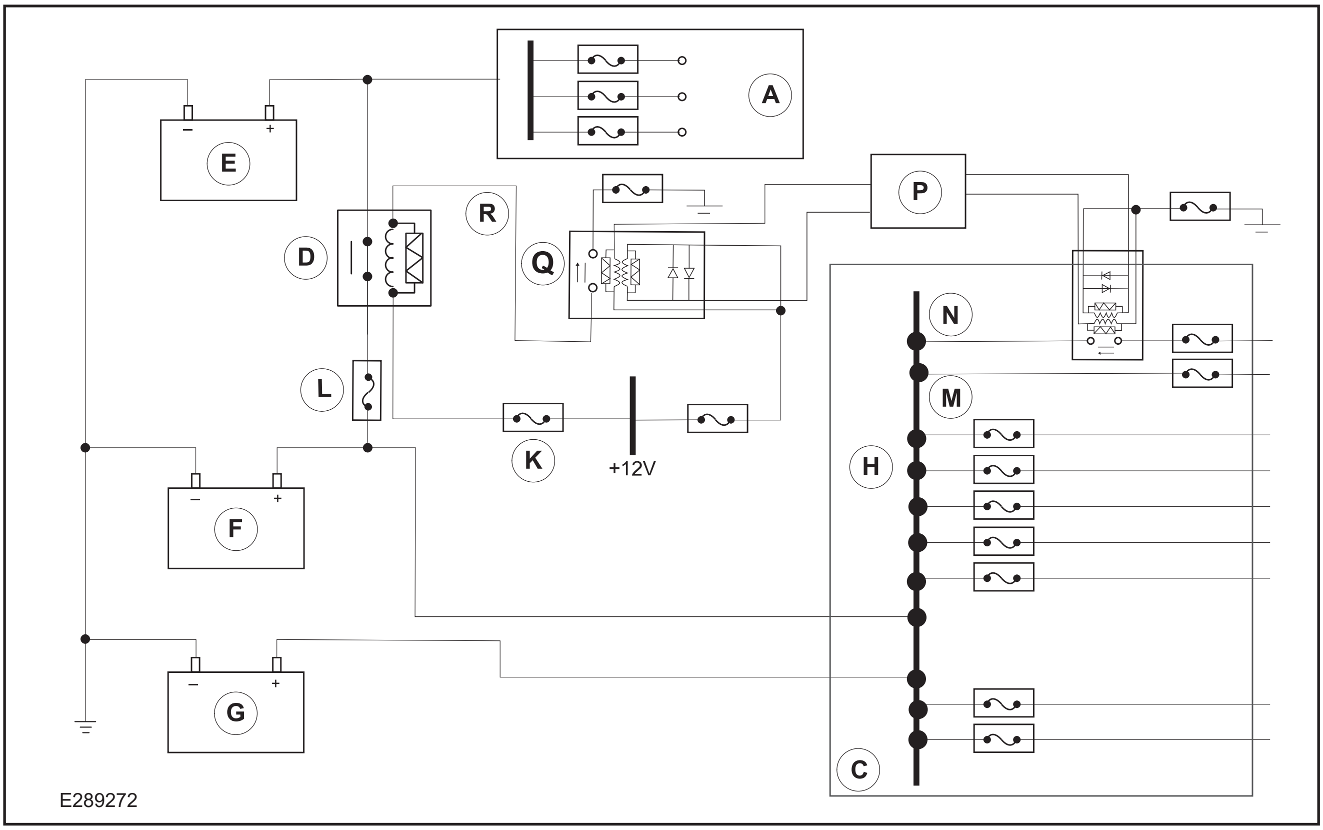
Refer to: 4.2 Wiring Installation and Routing Guides

Wiring Specifications table. For example: 245A has 70mm^2 CSA cable

- The third party positive conductor is mounted directly to the battery clamp with the supply for the BMS last, see figure E278335 Rev1

- No deformation to the Ford BMS can occur. The conductor terminal/eyelet may need to be inverted, see item 4 in figure E278335 Rev1
- Only one termination (third party conductor) can be added to the 6mm stud in addition to the BMS
- The Ford 6mm self-locking nut is to be re-used and torqued to 5.9 ft lb (8.0Nm) ± 0.89 ft lb (1.2Nm). Separate locking washers are prohibited
- A Mega inline fuse must be fitted as close to the 6mm stud as possible. Not to exceed 250A for short duration applications such as on Tippers, Cranes or Tail Lifts
- For long duration continuous power applications such as High Power Inverter, the Mega fuse must not exceed the rating of the alternator fitted to the vehicle. The alternator saturation voltage must be above 13.0V when testing full load. AGM battery twin system (HFQ) must be fitted to the derivative. See 'Single and Twin Battery System' and 'Power

Convertor Fit Third Party Battery Installation



Example of installation to existing Ford Power Supply Architecture

Item	Description
A	Convertor Fit — Loads
C	Pre Fuse Box — Driver's Seat Pedestal
D	Convertor Fit — Normally open latched third party Battery Control Relay
E	Convertor Fit — third party Battery
F	Ford Fit — Auxiliary Battery(1)
G	Ford Fit — Vehicle Start Battery
H	Ford Fit — Loads (from Auxiliary Battery)
K	Convertor Fit — +12V Fused KL30 Supply
L	Convertor Fit Power Supply Fuse (For loads between 175-240A)
M	CCP1 - 60A standard
N	CCP2 - 175A relay and Mega fuse (with any Fuse Box option (including)JZGAE/Twin Batteries)
P	BCM
Q	Ford fit SBG and load-shedding control relay
R	Ford fit signal/grid, 10A switched ground, controlled by SBG and load-shedding control relay

(1) Must be ordered as an extra option

Convertor fit power supply fuse may not be required if CCPs are the correct value.

and Connectivity Usage Recommendation' table in this section of the BEMM

- A higher ampere alternator must be fitted if long duration (greater than one hour) high loads are required. See 'Single and Twin Battery System' and 'Power and Connectivity Usage Recommendation' table in this section of the BEMM
- The Third Party High Power mode feature must be used for Engine Run applications. Refer to: 4.4 LV Charging System (12V)
- Efficient isolation of third party equipment, when not required, to minimize battery discharge/deep cycling. The load-shedding signal control offers this
- Testing for end customer usage, including duty cycle, at a range of temperatures and drive cycles, worst case
- Testing of the Vehicle Convertor's system must confirm no heating of Ford or third party cables or any junctions utilized, unless thermal protection is incorporated
- Testing of Vehicle Convertor's +12V conductor must demonstrate no loosening possible to Ford battery cable clamp
- No detriment to Ford systems from voltage drop/inrush current by third party system (functionality or warnings)
- If engine off can still operate the third party system, then testing also required in this vehicle state
- A charge balance must also be performed to confirm system has correct battery and alternator ratings
- If idle loading can saturate the alternator (fully load and go below 13.0V) then Engine RPM speed control system must be utilized to increase alternator output at idle
- The return ground cable is recommended, routed in parallel to +12V supply for EMC compliance
- When in Engine Run, systems that are not required should be turned off to help the alternator supply the main load of the third party system. This information should be passed on to the end user by the Vehicle Convertor
- The BEMM is adhered to in all relevant areas. This document allows connectivity to Ford battery clamp if the above criteria is met

4.5.8 Battery Monitoring Sensor (BMS)

WARNING: It is important that the battery box lid/covers are replaced after any conversions to the battery positive terminal. See figure E278335 Rev1. If the battery box lid/cover is missing or damaged, a replacement part must be ordered and fitted. It is recommended to check fitment as part of a quality control process.

CAUTION: Do not permanently remove jumper cable from the BMS.

NOTE: If the key off load only drops to the expected lower value after 30 minutes, it is probably because a feature is still active, controlled by the battery saver timer. This could be because any door is ajar or an interior lamp is switched on. Peripherals plugged into the power sockets will continue to drain power until the battery reaches a low level of charge.

The BMS continuously monitors the condition of the main battery (or twin batteries). To do this, it is bolted directly to the negative terminal of the battery. It is recommended that this is not removed. However, if removal is required, please refer to the Ford workshop manual, Ford dealer or customer services.

The BMS re-calibrates itself at regular intervals. This occurs during a rest period at key off, when the battery closed-circuit current is less than 100mA. The rest period must last for at least 4 hours.

It is recommended that the total Ampere consumption, in sleep mode, does not exceed 100mA. This is because BMS will not be able to accurately correlate the battery state of charge. Note there is approximately 15mA of key off load from existing Ford fit systems, so the additional maximum is 85mA of convertor fit system. Any third party installations should ideally be activated via ignition or engine run. However, a sleep mode of 100mA is still high and will lead to deep discharge. Regardless of battery system, long periods of discharge may necessitate long periods of recharge. See 'Power and Connectivity Usage Recommendation' table at the end of this section.

After convertor system is installed, it is recommended to measure total key off load to battery with either a current shunt or with a clamp on ammeter calibrated and sensitive to milliampere's (mA). Perform this test after 10 minutes of key off with all doors shut so that the vehicle remains in sleep mode.

4.5.9 Single and Twin Battery Systems

WARNING: It is important that the battery box lid/covers are replaced after any conversions to the battery positive terminal. If the battery lid/cover is missing or damaged, a replacement part must be ordered and fitted. It is recommended to check fitment as part of the quality control process.

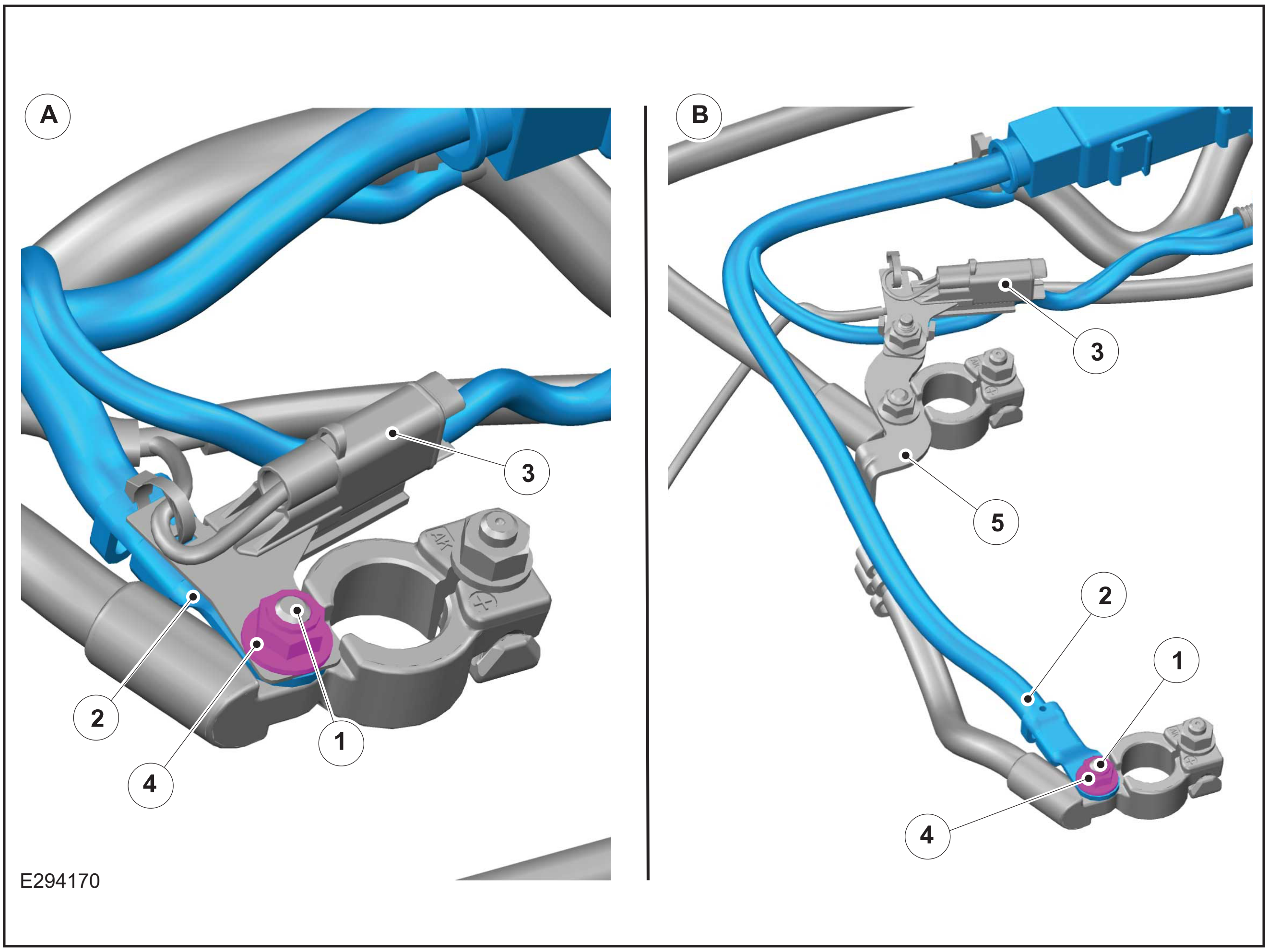
Battery Cables and Components

A vehicle ordered with a single battery can be modified to twin batteries.

Wiring of Batteries in Parallel for High Current Applications

Review whether an upgrade to a single AGM Battery would be sufficient or alternatively, if a higher current

Third Party +12V PTO Assembly



Item	Description
A	Single Battery Assembly
B	Twin Battery Assembly
1	+12V Battery Clamp 6mm Stud
2	Third Party Eyelet and Cable - Must be a tight fit to the battery clamp
3	BMS Fuse
4	Self-Locking Crimp Hexagonal Nut - Re-use and torque to 5.9 ft lb ± 0.89 ft lb
5	Twin Battery positive link cable with 6mm stud - LK4T-14300-D*

is required, an additional battery can be added as shown in the proposed interface schematic. In this case the load-shedding signal is used to control relay ‘D’, see figure E289272 ‘Convertor Fit Third Party Battery Installation’ diagram to allow the third party battery to be charged when the engine is running.

Also Refer to: 4.6 Battery Protection

Single to Twin Battery Conversion

Any additional or different batteries must be checked for correct functionality on and SRC vehicle, please refer to Battery Configuration, Additional Loads, and Smart Regenerative Charging (SRC) and also:

Refer to: 4.4 Charging System and
Refer to: 4.10 Electronic Engine Controls
If a requirement exists, it may be viable to order vehicles installed with a single battery, a battery disconnect relay and a kit of harnesses to be fitted by the installer. See following table for battery cables and components.

Battery Cables and Components

Vehicles ordered with a single H6 AGM battery can be converted to twin H6 AGM batteries. If using two batteries, both must be of the same type. The part numbers for the conversion are shown later in this section.

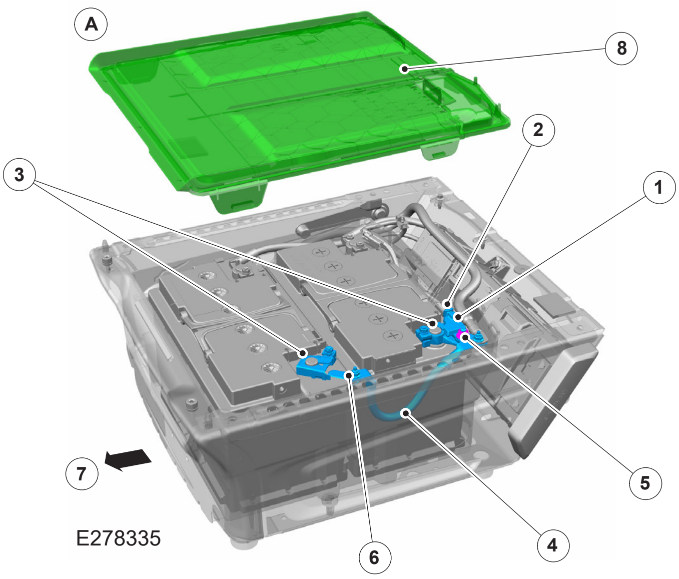
When changing the battery capacity or technology, the vehicle configuration must be updated after the new batteries have been installed. The vehicle needs to be connected to the Dealer Service Tool to reprogram the new batteries. Contact your National

Sales Company representative or local Ford dealer with your vehicle VIN. If they are unable to help you then please contact the Body Builders Advisory Service at bbasqa@ford.com. Failure to set the correct battery configuration may lead to incorrect SRC/SC functionality.

Generic items when converting from Single AGM to Twin AGM Batteries

Part Number	Description	Quantity
LK4T-14301-B*	Twin Battery Ground Jumper Cable with auxiliary ground stud	1
LK4T-14300-D*	Twin Battery Positive Jumper Cable (no auxiliary positive stud)	1
LK4V-14300-J*	Twin Battery Positive Jumper Cable with auxiliary positive stud	1

Battery Box Lid/Covers



Item	Description
A	Vehicles with H6 Batteries
1	Battery Monitoring Sensor (BMS) KK3T-10C652-A*
2	Plug-in connection — Local Interconnect Network (LIN) and Battery Positive +12V (B+) Feed
3	Connection to Negative Terminal of Main Battery Post — See 'Battery Cable Fixing Torque'
4	Jumper Cable (LK4T-14301-B*) only with twin batteries
5	1x M8 nuts. Do not loosen or remove
6	1x M6 nut. Do not loosen or remove
7	Front of vehicle direction
8	Battery Box Lid

4.5.10 Additional Loads and Charging Systems

NOTE: Do not make any additional connections to the Power Distribution Box (PDB) terminals, as over-torqueing could cause damage to the PDB. Any electrical loads should be taken from the CCP. For applications that require a permanent installation to gain power for jump start requirements for example recovery vehicle conversion, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com

4.6 Battery Protection

NOTE: If a third party battery guard is fitted, it must be connected to the load-shedding signal so that EPAS is protected in the event of an overload at engine run.

NOTE: For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builders Advisory Service at bbasqa@ford.com

4.6.1 Interior Lights and 12V Sockets

12V sockets and interior lighting are both controlled by timers and SOC control. Both reset at vehicle wake for example, door opening. These will switch off earlier if battery is low.

- 12V sockets - 30 minutes from key off
- Interior lighting - 10 minutes from key off (there are some options where the interior lighting has been extended to 30 minutes)

4.6.2 Standard Battery Guard (SBG) and Load-Shedding

WARNINGS:

When connecting a third party load, these installation instructions must be followed to avoid low system voltage during normal driving operation.

The load-shedding system must not be disabled or interfered with.

Vehicles with Single or Twin batteries should always fit battery guards if engine off power is required.

If a third party battery guard is fitted, it must be connected to the load-shedding signal so that EPAS is protected in the event of an overload at engine run.

NOTE: It is recommended to maintain the vehicle battery to a good level of charge to avoid load-shedding events.

Load-shedding is a system protection feature to stop excessive voltage drops at engine on. At engine off this system helps stop excessive battery drain which could lead to a failed start. To protect the system from sudden voltage drops it will on rare occasions of extreme conditions be necessary to disconnect high-current third party electrical loads. All third party electrical loads totalling over 60A must be connected under one or other method of load-shedding control. Charge balance system testing is expected of the third party system with any Ford system loads, to ensure that the voltage does not go lower than 13.0V at engine run. If 11.0V is measured, this is the cut off point for load-shedding but here there would be serious problems with the system design of supply and demand.

At engine-off, it helps prevent excessive battery discharge with a SBG.

To avoid the risk of there being load-shedding during engine run in a **stationary** electrical Power Take Off (PTO) requirement, two systems are recommended to be utilized:

1. **Third Party High Power Mode override feature**
   This will help maintain the highest voltage by forcing the charging system into conventional charge mode.
2. **Engine RPM speed control feature**
   This can help increase current output of the charging system by increasing the engine idle. Charge balance system testing is expected of the third party system with any Ford system loads, to ensure that the voltage does not go lower than 13.0V at engine run. If 11.0V is measured, this is the cut off point for load-shedding but here there would be serious problems with the system design of supply and demand.

4.6.3 Power Connections

This section explains where to connect third party electrical power connections, based on the power that will be drawn.

Ground connections are not controlled

Refer to: 4.25 Grounding

Connections without SBG and Load Shedding

NOTE: Suitable for up to 60A total.

A total limit of 60A applies to all non-sheddable third party electrical loads added to the vehicle, across all locations including the following:

- Customer Connection Point 1 (CCP1)
- Camper connection (C Connector)
- The Auxiliary Fuse Panel (JZGAE)

Refer to: 4.24 Electrical Connectors and Connections

All higher current third party loads are to be regulated using Ford controlled load-shedding.

Optionally, third party loads below 60A can also be connected to the load-shedding control system to make use of the protection from battery drain that this may provide.

It is required to connect loads with over 100mA continuous drain to the load-shedding system.

Connections using SBG and Load Shedding

This provides some protection of the battery for parked vehicles, and some protection of system voltages when the vehicle is running.

Regulation by load-shedding is required where total added electrical load is over 60A. Regulation by load-shedding is also optional for connections totaling less than 60A.

Load-shedding for third party systems is to be installed using one of the following 2 methods:

1. **Using the provided third party isolation signal directly.**

- This is a switched ground system
- The control wire can supply relay coil currents up to 10A total, for connected third party control relays
- The control signal is routed to the following locations
    - 10-way standard interface connector in the driver's seat pedestal (pin 4)
    - The Auxiliary Fuse Panel, cloned, 10-way standard interface connector (JZGAE) (pin4)
- The control signal is to be used with a third party relay when Customer Connection Point 2 (CCP2) cannot be utilised. This control is also recommended when connecting leisure batteries.
- Camper 6-way (pin 1)

2. **Using Customer Connection Point 2**

CCP2 is a high current load-shedding connection point to provide robust power availability whilst maintaining vehicle operation

- Loads up to 175A may use CCP2
- CCP2 is provided in any of the below options:
    - Twin battery/heavy-duty battery pack
    - Aux Fuse Panel (JZGAE)
    - Refrigeration [FV]
    - Camper Donor vehicles

Refer to: 4.6 Battery Protection

4.6.4 SBG and Load Shedding - Functionality

WARNINGS:

⚠ **Changing configurations may invalidate the vehicle warranty.**

⚠ **Using Third Party High Power mode may invalidate the vehicle warranty.**

⚠ **Ensure the Third Party High Power mode feature does not inadvertently remain active when the battery is being charged by the vehicle.**

⚠ **Use of the Third Party High Power mode feature to override the connection timeout will allow more energy to be discharged from the vehicle battery. Excessive energies cycled through the battery may invalidate battery warranty.**

⚠ **When designing automation of the Third Party High Power mode, avoid unintended consequences. If activated when the engine is running, use of Third Party High Power mode can also prevent AEIS, where applicable. Use of Third Party High Power mode can disable this safety feature and leave the engine running/vehicle ready to drive. Engines that run in confined spaces cause CO accumulation which can lead to CO poisoning and death. CO can seep into adjacent confined spaces. The AEIS inhibit can be configured off at a Ford dealer.**

Standard Battery Guard - Vehicle -Off

Standard Battery Guard (SBG) operates when the vehicle is off. The purpose of the SBG is to protect the vehicle battery from being drained.

It disconnects the controlled third party circuits when the battery is low or after timeout has occurred. Timeout is up to 30 minutes for single-battery vehicles and up to 75mins for vehicles with twin AGM batteries. Twin AGM batteries have a lower SOC threshold and can offer for longer duration.
Refer to: 4.5.9 Single and Twin Battery Systems

Normally the SBG is configured to reconnect at vehicle unlock. The circuits are then connected before the 'key crank'.

Camper vehicles do not reconnect at 'unlock'. Instead reconnection is delayed to about 3s after 'ignition on' to allow the vehicle to be cranked first. This is intended for vehicles with Gel batteries. With this configuration, the third party load-shedding circuits are disconnected as soon as both the key is out and the driver door is opened. Other non-Camper vehicles can be configured the same, by a Ford dealer.

The Third Party High Power Mode inhibits the timer so the SBG monitors for low SOC only. The user must ensure the Third Party High Power Mode is not used during normal drive cycles except where required for third party equipment.
Refer to: 4.4 LV Charging System (12V)

The SBG does not offer warning if an external charger is connected to the vehicle. It will not automatically connect all batteries if an external charger is applied. .

Load Shedding - Vehicle -On

In rare situations of very high electrical demand, it is necessary that the system can act to prevent the voltage from becoming too low. Essential loads, including some 3rd-party loads, will never be shed. Loads totaling over 60A must be connected to the Load-Shedding function.

The ability to do Vehicle-On load-shedding is required in order to be able to prevent too low voltage during driving.

Short Term Disconnection - Contributing Factors

- Extreme environmental conditions
- High system electrical load at or already exceeding power supply capacity – including third party loads

- During short term high transient loads, such as inrush currents

If the system voltage drops very low, disconnection of the controlled third party loads may occur. This will be for a minimum of 4 seconds.

If load-shedding occurred, third party equipment may be reset and may re-initialize.

For Battery configuration Refer to: 4.5.9 Single and Twin Battery Systems

Driver Notification

Driver Notification Instrument Cluster Notification is provided to alert the driver that third party connections have been reset, and that this may indicate an overload condition has occurred.

A customer information message is displayed briefly on the Instrument Panel Cluster (IPC). The message is “Electrical Power Saver Active Features Turned Off”.

Where the warning occurs frequently, it is recommended to review the Power Supply requirements, and additional generating equipment may be required.

No message is given when power is restored. If CCP2 is fitted an audible click may be heard from the driver’s seat area.

Longer Term Disconnection

If the 12V SOC is very low when load-shedding occurred, the load-shedding will remain active until the 12V SOC has been raised significantly. This will take longer in cold conditions or with old batteries. This condition inhibits activation of Auto-Park-Assist.

After a Flat Battery

An indication of continuous flat batteries is that the SBG has not been utilized.

4.7 Climate Control System

WARNING: Do not use propylene glyco based coolant.

NOTE: The Transit Climate Control system utilizes shared components from other vehicles, which may have higher feature levels and systems. Therefore, in addition to pins that are not used generally, there are others that are not available and could impede function or cause damage if connected for external us

- Never secure hoses or tubes to the transmission fill or dip stick or to any fuel system or brake component
- Do not route heater or refrigerant lines near or directly over any exhaust system component, including the exhaust manifolds
- Avoid routing of hoses in the wheelhouse or stone kick-up arch. If routing is required in these areas, shield against stone pecking as appropriate
- Do not route hoses near sharp edges. Utilize guards to protect against cutting or chafing

4.7.1 Front Climate Control System

J1 Climate Control System Pin-Outs

Pin	Description
1	Ground
2	Voltage Reference Return
3	Voltage Reference
4	Third Party High Power Mode (For Vehicle Convertor Use)
5	A/C Request (For Vehicle Convertor Use)
7	Rear Defrost Output
8	Left Temp Door Feed ‘A’
9	Left Temp Door Feed ‘B’
10	Left Temp Door Feedback
11	Front Blower Relay Output
14	Eco/Selectable Drive Mode Input
17	MS1-CAN Bus High
18	MS1-CAN Bus Low
19	Evaporator Temp Sensor Input
20	Mode Door #1 Feed ‘A’
21	Mode Door #1 Feed ‘B’
22	Mode Door #1 Feedback
23	Front Blower Controller PWM Command Output
24	Recirc Door Feed ‘A’
25	Recirc Door Feed ‘B’
26	Battery Power Supply (+12V)

Any pins not listed in the table above are not to be used.
PTC= Positive Temperature Coefficient, NTC= Negative Temperature Coefficient

🟩 Abc = BEV Only 🟦 Abc = ICE Only

J2 Climate Control System Pin-Outs

Pin	Description
1	Voltage Battery Left Heated Seat Element supply
2	Voltage Battery Right Heated Seat Element supply
6	PTC PWM output
12	Heated Windshield Right Relay Driver
15	Right Heated Seat NTC Sense
16	Left Heated Seat Element Output
17	Right Heated Seat Element Output
23	Start-Stop Disable Button Input
24	Start-Stop Indication Output
28	Heated Windshield Left Relay Driver
30	Left Heated Seat NTC Sense

Any pins not listed in the table above are not to be used.
PTC= Positive Temperature Coefficient, NTC= Negative Temperature Coefficient

4.7.2 Rear Climate Control System

J2 Climate Control System Pin-Outs

Pin	Description
1	PWM Signal Blower
2	Temp Door 3
3	Temp Door 1
8	Ground
10	Ignition Signal (KL15)
11	Battery Power Supply (+12V)
14	PWM Signal Blower(2)
15	Temp Door 4
16	Temp Door 2
23	Temp Door Power Supply (KL30)
24	Backlighting Illumination (KL58)

Any pins not listed in the table above are not to be used.

PTC= Positive Temperature Coefficient, NTC= Negative Temperature Coefficient

4.8 Instrument Panel Cluster (IPC)

⚠ **WARNING: Do not tamper with, cut into or connect to any of the CAN-Bus interface wiring or connectors.**

Most of the functions are managed over the CAN-Bus interface.

Instrument Cluster

Connector Pin (C1)	Description	Wire Color	
2	Fuel Level Sensor Return	Green/Blue	-
3	Ground	Black/Violet	-
4	Switch - Transmission Park Detect	Green	-
8	12V Power	Gray/Red	-
10	Fuel Level Sensor	Yellow/Violet	-
11	Switch - Low Level Washer Fluid	Gray	-
12	CAN Bus High Speed -High	Green/Blue	Twisted pair
13	CAN Bus High Speed -Low	White/Green	

Any pins not listed in the table above are not to be used.

4.9 Horn

A dual horn may be fitted to the vehicle in place of the single horn.

Any other aftermarket horn (for example an air horn) will need to be driven by a separate relay energized by the horn circuit.

4.10 Electronic Engine Controls

CAUTION: Do not make any additional connections to the electrical circuits associated with the engine management system.

NOTE: It is not necessary to disconnect or remove engine management modules

4.10.1 Automatic Engine Idle Shutdown (AEIS)

WARNING: AEIS (where fitted)is a safety system designed to automatically shut off the engine after 30 minutes of operation to mitigate the accumulation of vehicle emissions such as "toxic carbon monoxide (CO)" in enclosed areas. This measure is essential to safeguard against vehicle emissions poisoning, which can have fatal consequences.
Using the Third Party High Power mode may inhibit AEIS or disable this safety feature. Avoid using the Third Party High Power mode that inhibits AEIS in confined spaces 4.10.2 Changing Vehicle Speed Maximum Setting

4.10.2 Vehicle Maximum Speed Setting

The Vehicle Speed Maximum Setting can be changed via the IDS menu under the following tabs: Toolbox, Powertrain, Service, Functions, PCM. The IDS on screen menus will guide the dealer through the options and setup.

4.11 Information and Entertainment System

4.11.1 Audio Head Unit (AHU) - Multimedia in Car Entertainment (ICE) Pack Summary

The Multimedia System you have, as a standard fit, will depend on the market region, body style and model of the vehicle.

NOTE: Depending on the vehicle upgrade you are planning it is important to order the right level parts that include new Instrument Panel Harness, Instrument Panel Bezel and Hood.

NOTE: Pre Equipment Pack does not have wiring between the roof-mounted AM/FM antenna and the co-axial cable that connects to the AHU. If planning to retrofit an AHU you will need to order the Pre Equipment Pack

AHU/Multimedia ICE Packs

AHU/ICE Pack	Description
17	Pre Equipment Pack - no audio
18	Connected Radio
19	Low Radio with SYNC without SDARS/HD
20	Low Radio with SYNC with SDARS/HD
21	Mid Radio with SYNC without SDARS/HD
22	Mid Radio with SYNC with SDARS/HD
28	High Radio incl. Navigation with SYNC with SDARS/HD
30	Connected Radio with DAB (GCC Markets only)

AHU/Multimedia ICE Pack Content

Description	17	18	19	20	21	22	28	30
Less ICE	X	-	-	-	-	-	-	-
Connected HMI Radio AM/FM	-	X	X	-	-	-	-	-
Connected HMI Radio AM/FM/DAB	-	-	-	-	-	-	-	X
SYNC Radio FM/AM	-	-	-	-	-	-	-	-
SYNC Radio FM/AM/SDARS	-	-	-	X	-	X	X	-
Less Display	X	-	-	-	-	-	-	-
4” Display	-	X	X	X	-	-	-	X
8” Display	-	-	-	-	X	X	X	-
Less ICP	X	-	-	-	-	-	-	-
Mini ICP - 10 Buttons without SYNC	-	X	-	-	-	-	-	X
Mini ICP - 10 Buttons with SYNC	-	-	X	X	-	-	-	-
Mini ICP - 5 Buttons	-	-	-	-	X	X	X	-
Front Speakers (4 Speakers)(1)	X	X	X	X	X	X	X	X
1st + 4th Row Speakers (6 Speakers)(1)	-	X	X	X	X	X	X	-
1st, 3rd + 4th Row Speakers (8 Speakers)(1)	-	X	X	X	X	X	X	-
Less Dunnage	-	X	X	X	X	X	X	X
Dunnage - Cutaway only	-	X	X	X	X	X	X	-
Single AM/FM Antenna	X	X	X	-	-	-	-	X
Single AM/FM + SDARS	-	-	-	X	-	X	X	-
Less Navigation	X	X	X	X	X	X	-	X
Navigation	-	-	-	-	-	-	X	-
Less Radio Controls	X	-	-	-	-	-	-	-
Radio Controls on Steering Wheel	-	X	X	X	X	X	X	X
Less SYNC	X	X	-	-	-	-	-	X
SYNC Gen 3	-	-	X	X	X	X	X	-
Less Microphone	X	-	-	-	-	-	-	-
Microphone	-	X	X	X	X	X	X	X
2 X USB Accessory	-	X	-	-	-	-	-	X
Media Hub (x2 USB)	-	-	X	X	X	X	X	-

(1) Speakers are dependent on body style

4.11.2 Connected HMI Radio and Connected HMI Radio with DAB

NOTE: There is a black co-axial cable for the fender-mounted AM/FM/DAB antenna that goes to the AHU.

NOTE: There are two black USB cables, which go to the radio. One of the USB cables has grey connector and the other one has a black connector.

NOTE: There is a blue co-axial cable for global navigation satellite system (GNSS) antenna that connects to the back of the AHU.

NOTE: CHR will only work with SDM4 display and the mini-ICP version for this combination.

NOTE: There is a black LVDS Cable which is connected to the radio via a Blue connector. SDM4 display is powered via this LVDS cable and serial communication between radio & display takes place through this cable.

Connected HMI Radio (CHR) is connected to the instrument panel wiring harness via a single 32 pin connector. Although there are two connectors on the radio side, only one connector is utilized for CHR.

32 Pin Connector ICE

Pin	Description	Type	Pin	Description	Type
1	Battery	Input	17	External CD In Right +	Input
2	Right Front Speaker -	Output	18		
3	Right Front Speaker +	Output	19	CAN-High	Input/Output
4	Ground	Ground	20		
5	Left Rear Speaker -	Output	21		
6	Left Rear Speaker +	Output	22		
7	Left Front Speaker -	Output	23		
8	Left Front Speaker +	Output	24		
9	Right Rear Speaker -	Output	25	RVC -	Input
10	Right Rear Speaker +	Output	26	Microphone -	Input
11			27	External CD In Left -	Input
12			28	External CD In Right -	Input
13	Microphone Shield	Input	29	LIN	Input/Output
14	RVC +	Input	30	CAN-Low	Input/Output
15	Microphone +	Input	31		
16	External CD In Left +	Input	32		

🟩 Abc = BEV Only 🟦 Abc = ICE Only

4.11.3 SYNC Radio and SYNC Radio with SDARS

NOTE: There is a black co-axial cable for the fender-mounted AM/FM antenna that goes to the AHU.

NOTE: SYNC Radio is present only when SYNC3 Module is available.

NOTE: There is a blue co-axial cable for global navigation satellite system (GNSS) antenna that connects to the back of the SYNC Module.

SYNC Radio is connected to the instrument panel wiring harness via two 32 pin connectors.

SYNC Radio Main Connector J1

Pin	Description	Type	Pin	Description	Type
1	Battery	Input	17	External CD In Right +	Input
2	Right Front Speaker -	Output	18		
3	Right Front Speaker +	Output	19	CAN-High	Input/ Output
4	Ground	Ground	20		
5	Left Rear Speaker -	Output	21		
6	Left Rear Speaker +	Output	22		
7	Left Front Speaker -	Output	23		
8	Left Front Speaker +	Output	24	Not Used	
9	Right Rear Speaker -	Output	25	DRDL_RX -	Input
10	Right Rear Speaker +	Output	26		
11			27	External CD In Left -	Input
12			28	External CD In Right -	Input
13	Not Used		29		
14	DRDL_RX +	Input	30	CAN-Low	Input/ Output
15			31		
16	External CD In Left +	Input	32		

SYNC Radio Main Connector J2

Pin	Description	Type	Pin	Description	Type
1			17	Not Used	
2			18	DRDL_TX +	Input/ Output
3			19	Alert In +	Input
4			20	Stereo In Left +	Input
5			21	Stereo In Right +	Input
6			22		
7			23	Not Used	
8			24		
9			25		
10			26	Not Used	
11			27	Not Used	
12			28	Not Used	
13			29	DRDL_TX -	Input/ Output
14			30	Alert In -	Input
15	Not Used		31	Stereo In Left -	Input
16	Not Used		32	Stereo In Right -	Input

4.11.4 Additional Rear Speakers

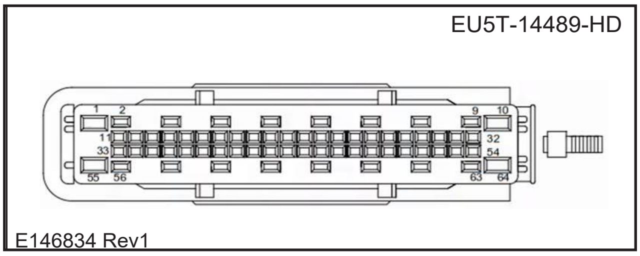
Rear speaker wiring is always present in the instrument panel harness 14K024, but not necessarily in the harnesses 14401 and 13A409/14A333 that then take the signals to the rear speaker locations.

When the rear speakers are not present at the body harness 14401/IP harness 14K024 in-line connector on low series variants the rear speakers may be spliced into the Audio Jumper Harness 14C007 at the rear of the Audio Head Unit, see next table for details.

Rear Speakers Spliced into the Audio Jumper Harness

Pin	Speaker	Wire Color
4	Right Rear (+)	Brown/White
9	Right Rear (-)	Brown/Blue
1	Left Rear (+)	White/Green
6	Left Rear (-)	Brown/Yellow

Rear Speakers In-line Connector (14401/14K024)



Item	Description
Pin 56	Rear Speaker Left + (White/Green)
Pin 57	Rear Speaker Left - (Brown/Yellow)
Pin 58	Rear Speaker Right + (Brown/White)
Pin 59	Rear Speaker Right - (Brown/Blue)

NOTE: For further details on Information and Entertainment System, parts and signals, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com.

4.12 Cellular Phone

⚠ **WARNING: Installation of any non-Ford-approved system is not recommended and operation with associated systems cannot be guaranteed. Any resultant damage will not be covered under warranty.**

Ford offer hands-free and wireless technology (Bluetooth) phone systems (including voice recognition) as factory-fit options, these will also be available as aftermarket accessory kits from your Ford dealership.

These use the Ford MS CAN multimedia bus to operate in conjunction with the Ford audio and navigation systems.

4.13 Exterior Lighting

WARNINGS:

Make sure that the modified vehicle complies with all relevant legal requirements.

Do not tamper with the base system (controlled by Body Control Module and multiplex architecture) and any feeds taken from the associated wiring or controller.

Due to significant wiring and control/ configuration differences between headlamp types, it is not possible to retrofit Bi-Xenon HID (High Intensity Discharge) or LED DRL (Daylight Running Lights) headlamps to vehicles not originally built with them. If Bi-Xenon HID or LED DRL headlamps are required, then these must be specified at time of ordering for factory fitment.

4.13.1 Reversing Lamps

Reversing lamps are activated by a high side driver in the Body Control Module (BCM). Accessories that add additional load, such as back up sounders, connected to the reverse lamp circuit, should be connected by a relay. Connecting such loads directly to the reverse lamp circuit could damage the BCM.

The load on the reverse lamps should not exceed a total of 5A + 250mA for a relay.

4.13.2 Lamps – Front Fog Lamps

National Regulations regarding inter-connection of front fog lamps with other lamps must be checked before designing the wiring circuit. The maximum permissible load with the standard system is:

- Front fog lamp - 2 x 35W (High side driver controlled).

4.13.3 Lighting Loads

The BCM exterior lighting outputs have shutdown protection in the event of an overload condition. If the overload condition is not addressed, the output will be shutdown permanently to protect the driver hardware. A dealer visit and/or BCM replacement may be required if overload condition is not removed.

Exterior lighting outage notification is only supported for turn indicator lamps by flashing the turn indicator telltales on the instrument cluster. There is no customer visible outage notification for other exterior lights, but diagnostic fault codes will be set for an open circuit on standard lighting functions where the load is sufficient to detect the outage, i.e. for lights which use bulbs instead of LEDs or a relay.

For Lighting Loads see 'BCM Output Information' table. Refer to: 4.3 Communications Network

4.13.4 Lamps – Hazard / Direction Indication

NOTE: If turn indicator bulbs are replaced with LED, the wattage needs to simulate the load expected by the bulb outage detection circuit. If LED indicators are supplemental to existing system, then the load resistor may not be required. When adding extra lamps, the convertor must check they comply with the legal requirements and that functionality is maintained.

The standard system configuration each side:

- 1 x Front Indicator 27W + 5W Side Repeater - max total front turn load 40W each side.
- 1 x Rear Turn Indicator 27W - max load 40W.
- For chassis cabs the standard combined stop turn lamps can be replaced by separate stop and turn circuits with LED lamps.

4.13.5 Lamps for Wide Vehicles

Lamps - End Outline and Side Marker Lamps

The maximum permissible load with the standard system is:

- 6 x 0.5W - Side Marker.
- 2 x 0.5W - End Outline Marker.
- 2 x 4W - Roof Marker.

Side Markers, End Outline Markers and Roof Markers are connected to the License Plate circuit.

When fitting additional Markers it is recommended to use LED lamps. Total Max load - 60W

Parking Lights

Two side parking lights (including license plate and marker lights) are available when the headlamp switch is set to POS.

When fitting additional markers it is recommended to use LEDs.

Parking lamps may switch off if left on for so long that the battery level becomes too low.

4.13.6 Electrically Operated Door Mirrors

WARNING: Do not tamper with the base system (controlled by Body Control Module and multiplex architecture) and any feeds taken from the associated wiring or controller.

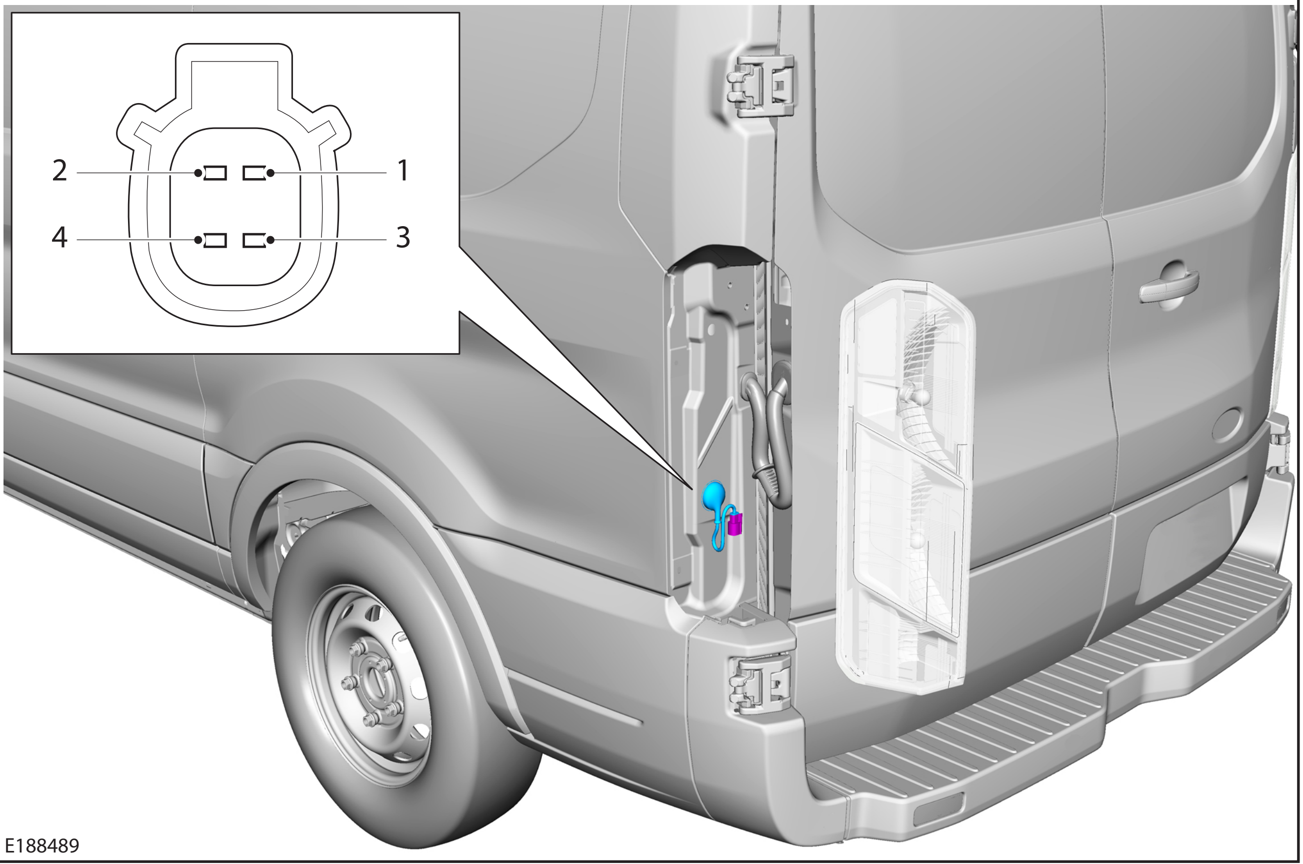
NOTE: These options are not suitable for aftermarket or convertor fit.

4.13.7 Power for Additional External Lamps

All power for additional exterior lamps must be taken through the Auxiliary Fuse Panel with a suitable switch and/or relay as required.

Refer to: 4.23 Fuses and Relays
Refer to: 4.24 Electrical Connectors and Connections

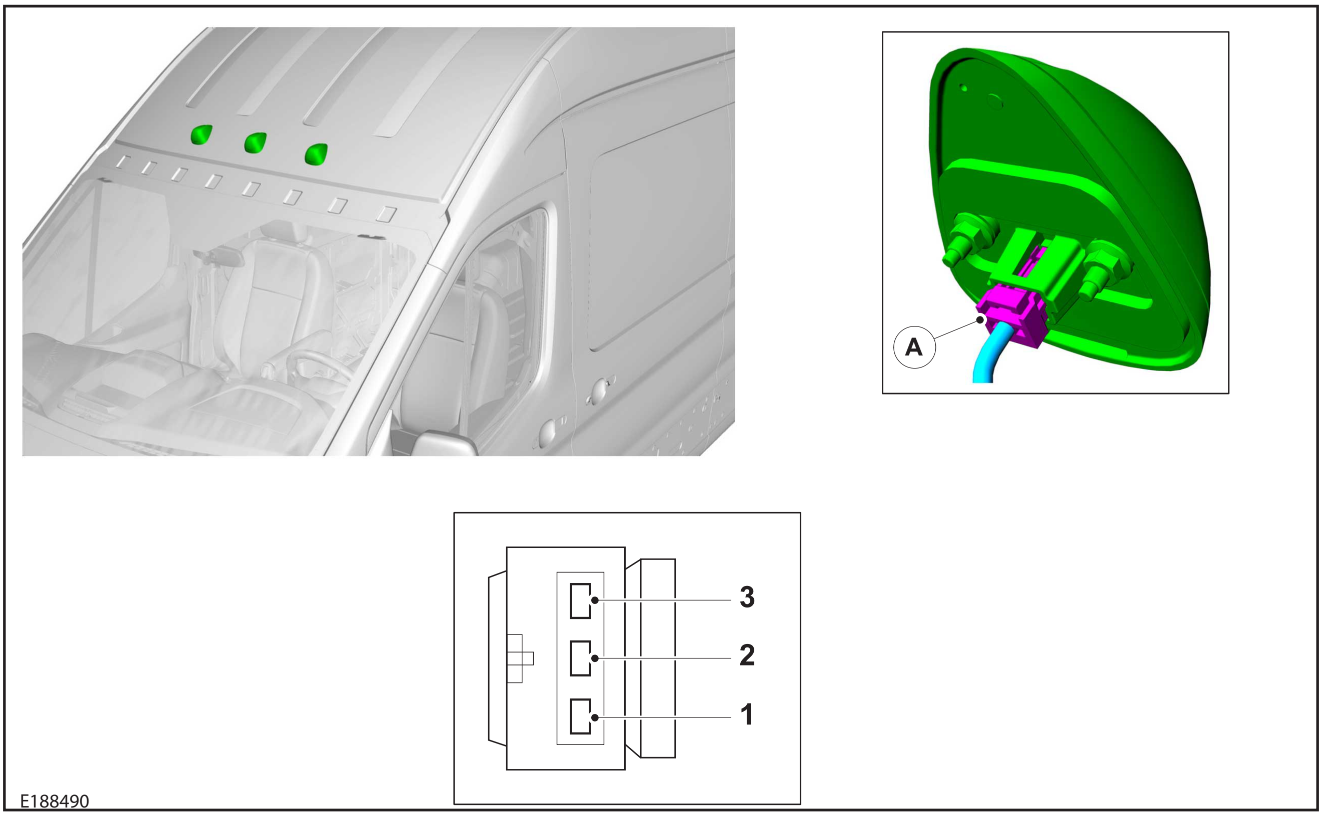
Rear Lamp Connector - Van, Wagon (LHS Shown)



Rear Lamp Connectors - Van, Bus, Crew Van (not CCAB or Cutaway)			
Lamp Assembly Tail Right		**Lamp Assembly Tail Left**	
Harness			
Connector SRW			
Mating Connector SRW			
Connector DRW			
Mating Connector DRW			
Pin 1	Ground - Pillar D Right 2nd Point	Pin 1	Ground - Pillar D Left
Pin 2	Park Rear Right	Pin 2	Park Rear Left
Pin 3	Stop/Turn Right Outboard	Pin 3	Stop/Turn Left Outboard
Pin 4	Reverse Left or Common	Pin 4	Reverse Left or Common

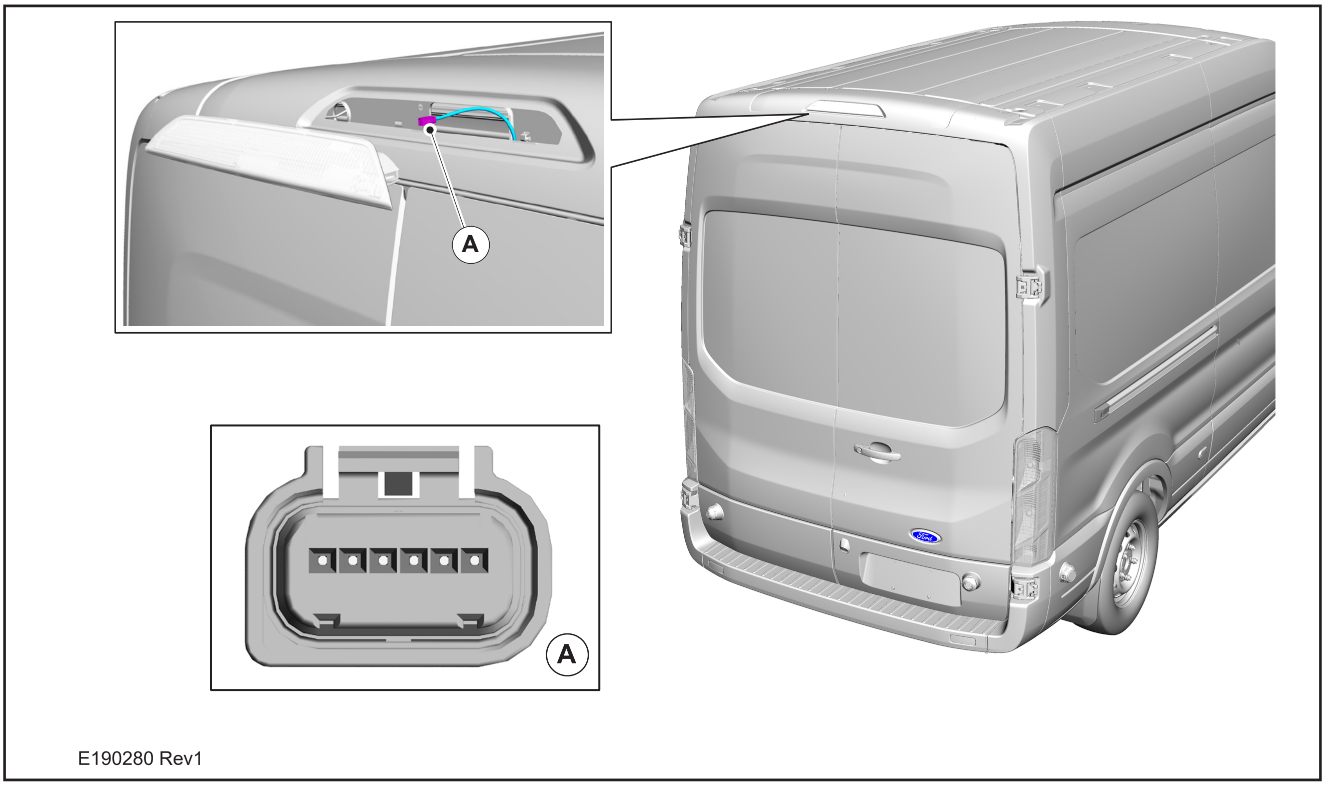
SRW - Single Rear Wheel, DRW - Dual Rear Wheel

Rear Lamp Connector - Van, Wagon (LHS Shown)



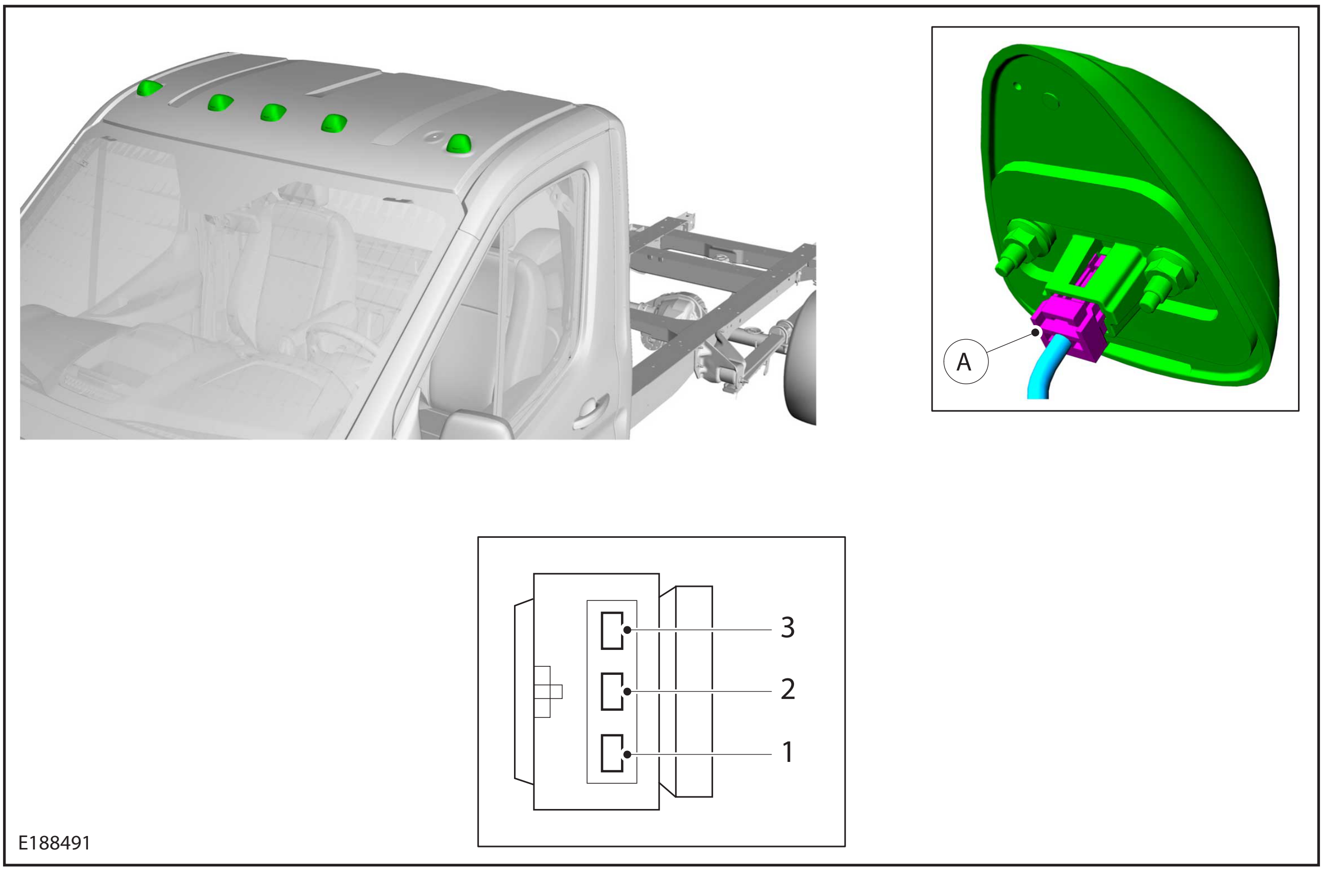
Front Roof Marker Lamps Van, Wagon (DRW)	
Harness	
Connector	
Pin 1	License Plate Lamps/Marker Lamps
Pin 2	-
Pin 3	Ground - Pillar D Right/Left

Rear Roof Marker Lamp Van, Wagon (DRW L4)



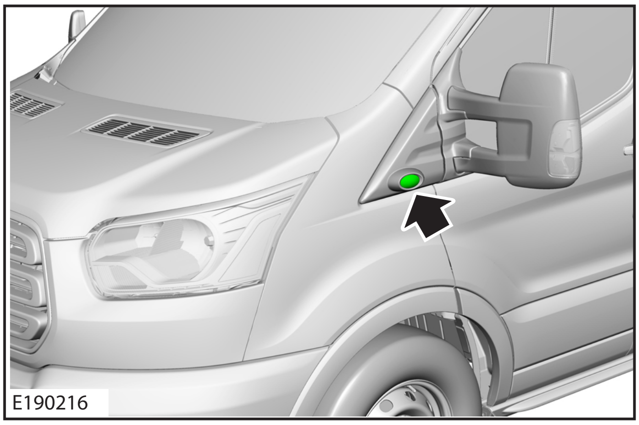
Item	Description
A	Rear Roof Marker Lamp Connector

Front Roof Marker Lamps - Chassis Cab/Cutaway



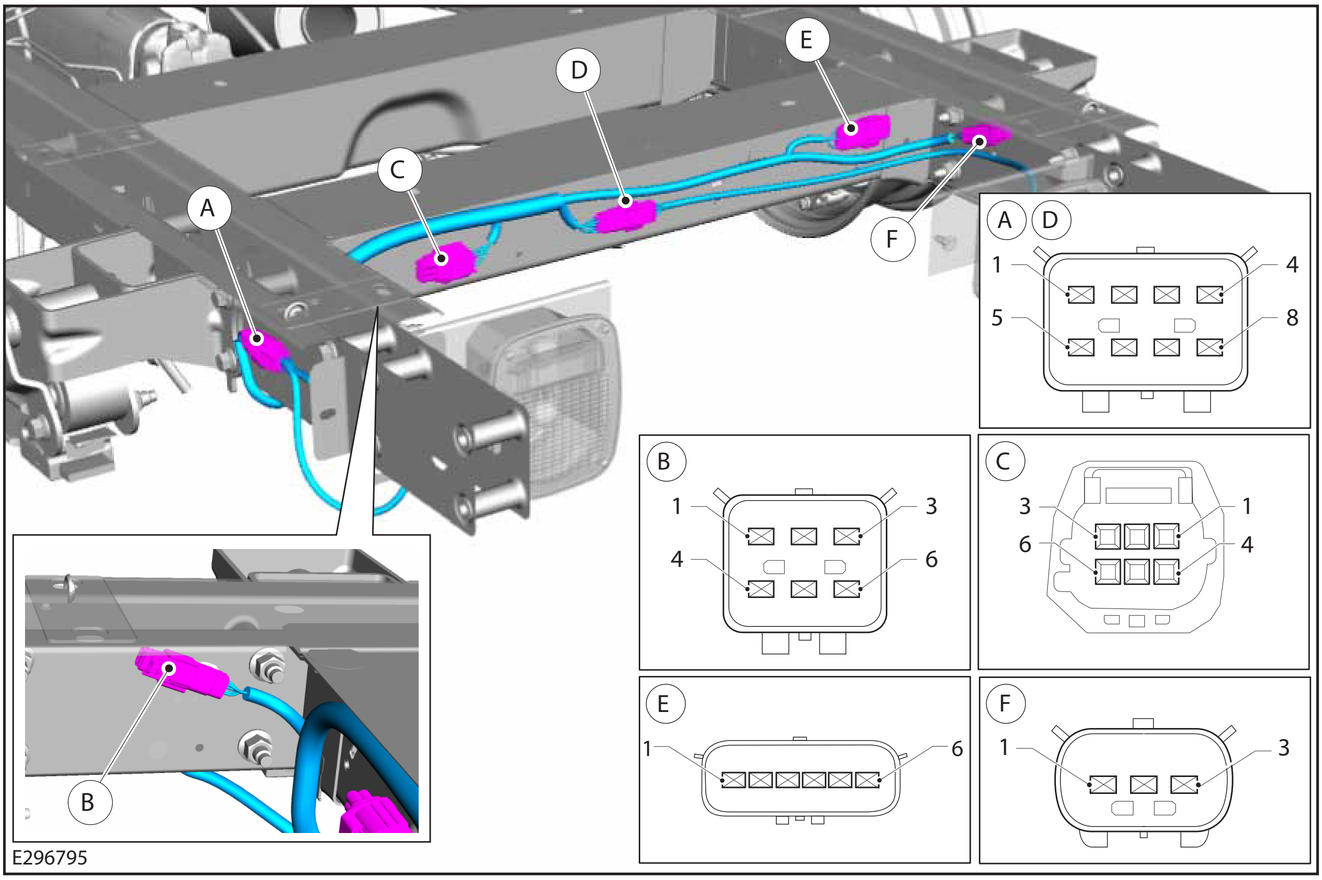
Front Roof Marker Lamps Van, Wagon	
Harness	
Connector	
Pin 1	License Plate Lamps/Marker Lamps
Pin 2	-
Pin 3	Ground - Pillar D Right/Left

Side Clearance Lamp (on jumper harness) - DRW vehicles only



🟩 Abc = BEV Only 🟦 Abc = ICE Only

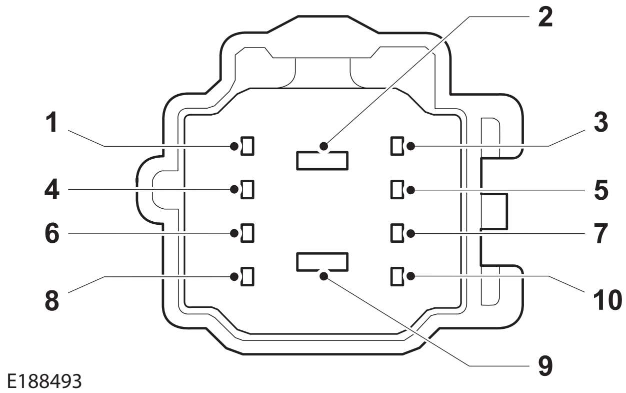
Rear Lamps - Chassis Cab/Cutaway (LHS Shown)



Rear Lamps - Chassis Cab / Cutaway (LHS shown)			
A	**Rear Lamp Connector - Left**	**D**	**Rear Lamp Connector - Right**
Pin 1	Stop/turn left outboard	Pin 1	Stop/turn right outboard
Pin 2	Stop	Pin 2	Stop
Pin 3	Turn	Pin 3	Turn
Pin 5	Park lamp rear left	Pin 5	Park lamp rear right
Pin 6	Backup	Pin 6	Backup
Pin 7	-	Pin 8	Ground
Pin 8	Ground	**E**	**Rear View Camera Connector**
B	**Licence Plate Lamp Connector**	Pin 1	Rear Power
Pins 1+4	License plate lamp	Pin 2	Rear Video +
Pin 2	-	Pin 3	Rear Video -
Pins 3+6	Ground	Pin 4	Rear Video D
C	**Trailer Tow Socket Connector**	Pin 5	Rear Ground
Pin 1	Stop/turn lamp left	Pin 6	Rear LIN Bus
Pin 2	Stop/turn lamp right	**F**	**High Mount Stop Lamp Connector**
Pin 3	Park lamps	Pin 1	Stop Lamp High Mount
Pin 4	Backup lamps	Pin 2	-
Pin 5	Power ignition on	Pin 3	Ground
Pin 6	Brakes		

Additional Position Lamps at the Rear of the Vehicle

Lighting Connector



E188493

Item	Description
Pin 8	Position Lamps

The feed for position lamps can be taken from the right back door inline connector, at the rear right hand side of the vehicle on 13A409 harness, pin 8 (yellow/violet), see figure E188493 or direct from the license plate feed connector, see figure E296795. The maximum load is 15W per side.

NOTE: Lighting connector shown in E188493 will require a local ground.

The position and parking functions operate independently.

Where applicable, when the position lamps are extinguished, the end-outline markers turn off simultaneously, in line with International Regulations No 48, which states the following:
The electrical connections must be such that the front and rear position lamps, the end-outline marker lamps (if they exist), the side-marker lamps (if they exist) and the rear license plate lamp can only be switched on and off simultaneously.

Connecting to Lighting Information

Additional Front Turn Lamps can be fitted using a relay - maximum total load 40W each side.

On Vans and Buses, combined Stop/Turn lamps are standard. Additional combined Stop/Turn lamps can be fitted up to a maximum load of 40W for each side.

On Chassis Cab/Cutaways, separate Turn Lamps can be connected. Maximum load is 40W for each side.

Additional lamps connected directly should be LEDs or should be powered by a relay

4.14 Interior Lighting

4.14.1 Additional Internal Lamps

CAUTION: The maximum total internal lamp load must not exceed 7A (105W).

Additional cabin interior lighting may be obtained by directly accessing the connector inside the dome lamp in the cabin.

For additional information on BCM
Refer to: 4.3 Communications Network

The battery saver system provides power for the interior lighting for a limited time.

Power Supply for the Interior Lights.

The BCM provides power to the interior lights by three outputs, two for courtesy and one for demand:

- Cabin light courtesy function - BCM pin C3-13 with maximum load of 5A
- Cargo light courtesy function - BCM pin C3-26 with maximum load of 5A
- Combined cabin and cargo light demand function - BCM pin C3-14 with maximum load of 5A

Each interior light circuit is grounded locally to the lamp. The lamps fitted to the cabin or cargo circuit depend on the vehicle type. To determine the lamps on the rear or cargo circuit:

- Set any lights with a switch to courtesy.
- Close all the doors and allow the lights to switch off.
- Open the door or lift gate at the rear of the vehicle.
- Any interior lights that switch on are in the rear cargo or rear zone. If all lights switch on then all the lights are in the same zone.
- Some vehicle types may have no lamps on the rear circuit

If fluorescent lighting is required it must not be connected to the existing interior cabin or cargo lighting as it is not compatible with the pulse width modulated (PWM) lighting circuit and may cause premature failure of the fluorescent lighting. If fluorescent lighting is required, it should be connected to the Auxiliary Fuse Panel.

4.14.2 Additional Lighting for Rear of Vehicle Interior

Where higher wattage installations are required, these should be taken through the Auxiliary Fuse Panel with a suitable switch and/or relay as required.

For additional information Refer to: 4.24 Electrical Connectors and Connections

4.15 Adaptive Cruise Control

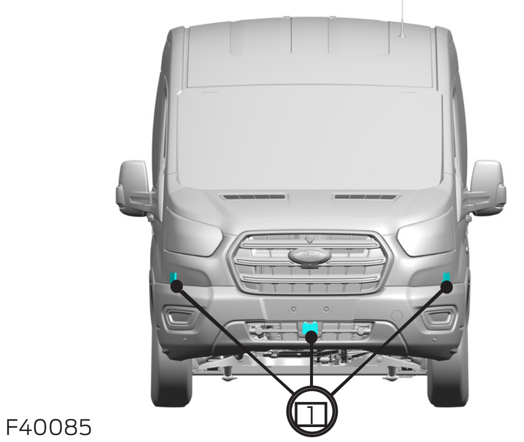
CAUTION: For converted vehicles fitted with adaptive cruise control, where vehicle mass or geometry is significantly altered it is recommended that the radar vertical alignment and system functionality is checked by a Ford dealer. For further information refer to Workshop Manual or Owner’s Manual.

NOTE: Do not obstruct the cruise control radar - Figure F40085

NOTE: For converted vehicles fitted with an Adaptive Cruise Control Radar, where vehicle mass or geometry is significantly altered, vertical adjustment - via the screw provided - and calibration for the radar sensor needs to be carried out.

NOTE: Do not paint the front grille of the vehicle as this may affect the functionality of the cruise control radar.

Adaptive Cruise Control Radar



F40085

Item	Description
1	Adaptive Cruise Control Radars

4.16 BLIS & Park Aid

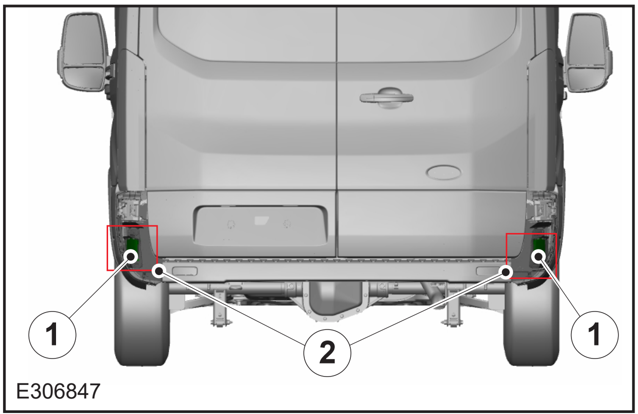
WARNING: The Blind Spot Information System (BLIS) feature will not function if any conversion or installation is in the field of the multiple-beam radar modules which are packaged in the rear quarter panels - one each side.

NOTE: Do not apply bumper stickers and/or repair compound to these areas, this can cause degraded system performance.

NOTE: The BLIS alert indicator(s) may turn on during heavy rain even though no vehicle(s) has entered the blind zone.

NOTE: If your vehicle has a tow bar with a factory equipped trailer tow module and it is towing a trailer, the sensors will automatically turn the BLIS off. If your vehicle has a tow bar but no factory equipped trailer tow module, it is recommended to turn the BLIS off manually. Operating the BLIS without the Blind Spot Trailer Tow package and a trailer attached will cause poor system performance.

BLIS location



Item	Description
1	Multiple-beam radar module
2	Clearance zone

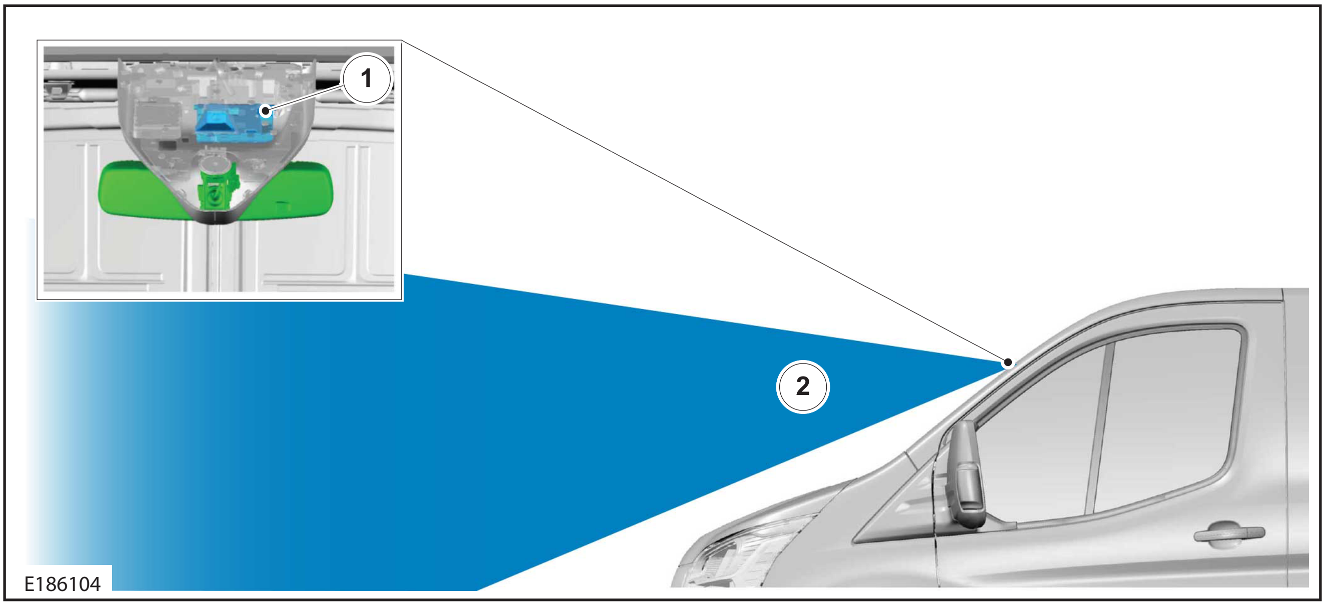
NOTE: For Chassis Cab and Cutaway variants please follow and adhere to the instructions and guidelines for BLIS and Park Aid as set out in the SVE Bulletin.

For Further information please go to the Body Builders Advisory Service https://fordbbas.com, or email bbasqa@ford.com

4.17 Front Windshield Camera

NOTE: The Front Windshield Camera features (if available: Pre-Collision Assist, Lane Keeping System, Auto High Beam, Traffic Sign Recognition, Intelligent Speed Assist, Wrong Way Alert, Adaptive Cruise Control, Intelligent Adaptive Cruise Control) will not function if any conversion or installation is in the field of view from the Front Windshield Camera.

NOTE: For converted vehicles fitted with Front Windshield Camera, where vehicle mass or geometry is significantly altered, a new calibration for the camera sensor needs to be made.



Item	Description
1	Front Windshield Camera located behind the interior rear view mirror trim
2	View cone from camera, horizontal direction and downwards to the hood edge of the vehicle

4.18 WIndshield Wipers

The base wiper system should not be tampered with (controlled by steering column control module and multiplex architecture with LIN technology).

NOTE: Power to wiper motors is limited by the size of the wiring and associated relays. If any alternative wiper installation is made, it must have a specification equivalent to Ford components.

Refer to: 5.10 Glass, Frames and Mechanisms

4.19 Auto Wipe and Auto Lamp for vehicles with large overhangs

NOTE: Where the modified vehicle has an overhang likely to cover part or all of the rain/light sensor position on the screen, see figure E175197, this may affect the sensor's ability to detect light or moisture to the defined calibration and will not function correctly. In the event that the Auto Lamp or Auto Wipe function has become impaired, the vehicle can be modified to have manual wipers and headlamps in the following way:

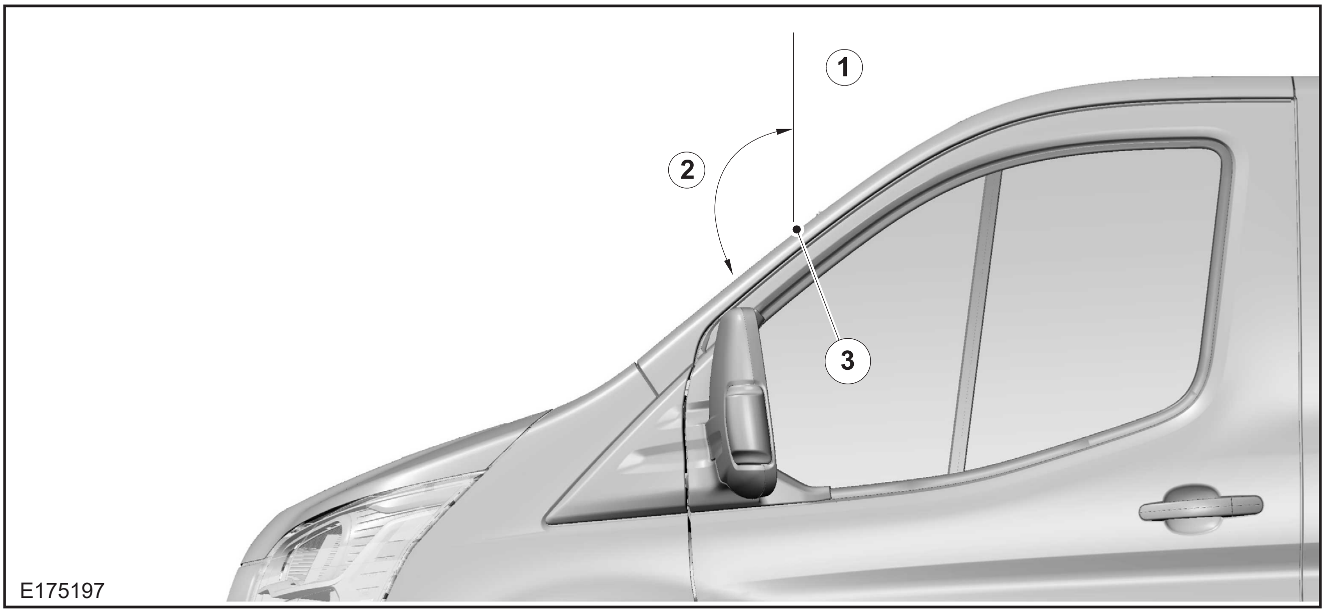
For wipers, there is a cluster menu option to switch wipers to variable intermittent rather than rain sensing. Use this setting instead.

For Auto Lamps, changing the headlamp switch to a non-auto switch will remove the auto position and the system will operate as if no sensor was present. If the Auto Lamp headlamp switch remains the customer may experience dipped beam remaining lit instead of daytime running lights (if fitted) or off with the ignition on and the switch in Auto. A Ford dealer can help advise which switch should be ordered and fitted, starting with part number JX7T-13D061-**

Be aware, when no headlamp switch Auto position is available (or Auto is not selected on the original switch), auto high beam (provided with forward facing camera) will also not be available or shown in the cluster.

Refer to: 4.18 Windshield Wipers

Refer to: 4.13 Exterior Lighting



Item	Description
1	Conversion or installation rearward where Auto Lamp and Auto Wipe feature will function correctly.
2	Conversion or installation forward of 132° where Auto Lamp or Auto Wipe feature may become degraded or NOT function correctly.
3	Auto sensor location.

4.20 Acoustic Vehicle Alerting System (AVAS)

⚠ **WARNING: Do not move or modify the components of the AVAS system. The Acoustic Vehicle Alerting System warning is a legal requirement.**

All E-Transit BEV vehicles are equipped with AVAS (Acoustic Vehicle Alerting System).

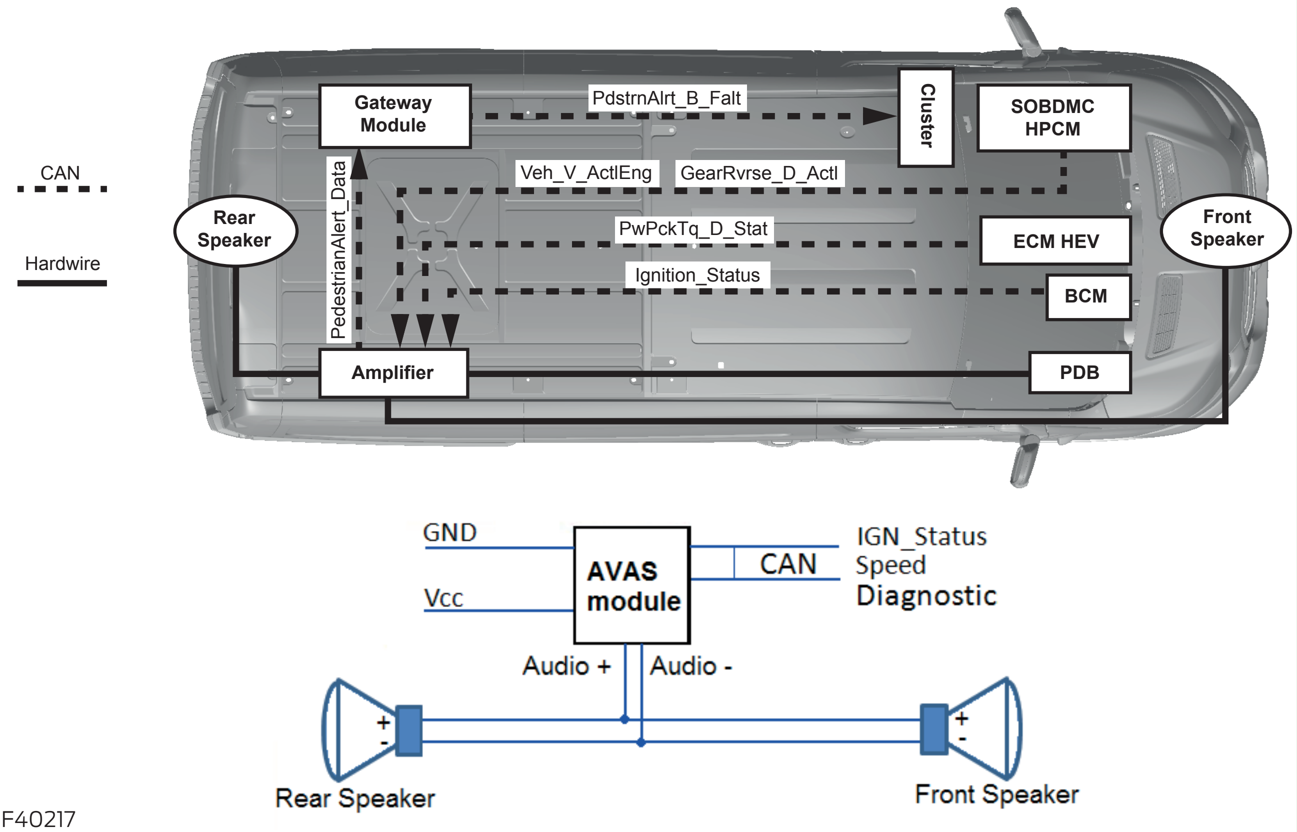
Changes to the AVAS system may influence the minimum required sound level.

Changes to the AVAS system may be: speaker position, sound radiation from the speaker to the outside of the vehicle, sound generation and amplification.

It is not permitted to remove, change position or obscure the AVAS speaker.

Converted vehicles, on the basis of a Chassis Cab or Cutaway, must not exceed the geometrical limits of a Van vehicle.

F40162


CAN
Hardwire
Gateway Module
PdstrnAlrt_B_Falt
Cluster
SOBDMC HPCM
PedestrianAlert_Data
Veh_V_ActlEng
GearRvrse_D_Actl
Rear Speaker
PwPckTq_D_Stat
ECM HEV
Front Speaker
Ignition_Status
BCM
Amplifier
PDB
GND
Vcc
AVAS module
CAN
IGN_Status
Speed
Diagnostic
Audio +
Audio -
+
-
+
-
Rear Speaker
Front Speaker

F40217

4.21 Emergency Call Systems

NOTE: Reception testing or loss of performance due to poor conversion/reinstallation are not the responsibility of Ford Motor Company.

NOTE: All vehicles with ICE Pack 16 and above will have the Emergency Assist function.

NOTE: For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com

4.21.1 GNSS/4G Antenna Relocation Kit

If the antenna performance is negatively affected by your conversion or you need to relocate the antenna, refer to the following table for the parts required and follow the recommended instructions on how to fit an antenna in a suitable location.

The existing antenna cable is always located on the RHS ‘A’ pillar.

The existing antenna should be disconnected and left in place for waterproofing. The extension cable, and splitter if needed, should be attached to the connector of the existing antenna cable at the A Pillar. This can then be routed to a suitable location on the conversion, ideally on the highest suitable vehicle surface and connected to the new antenna.

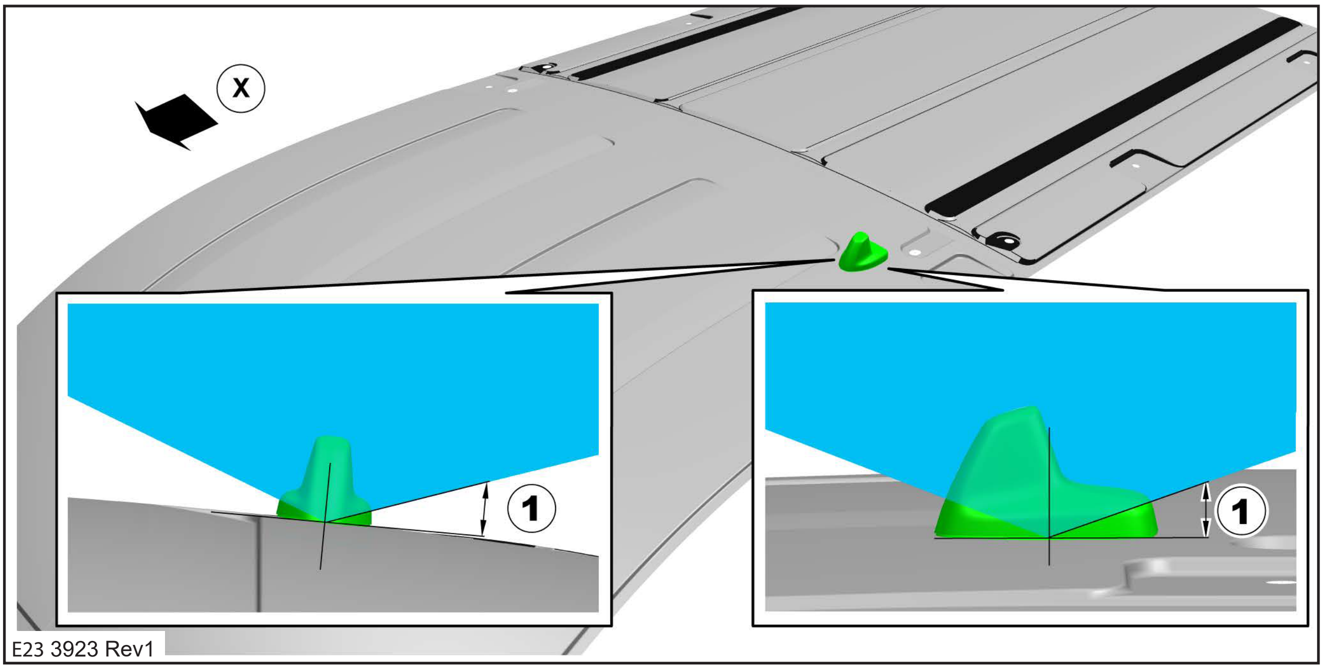
Item	Part Number
Full kit	KTKK3T-18812-AFA
Cable extension	KK3T-18812-AFA
Cable splitter	KK3T-18812-AEA
Shark fin antenna	GJ5T-19K351-AB
Ground plate	KC3T-500A80-AA

4.21.2 Relocation of GNSS/4G Antenna

NOTE: The antenna is provided with a seal that fits to the roof surface, but it is the responsibility of the Vehicle Convertor to ensure an adequate waterproof seal is achieved.

If it is unavoidable and necessary to fit an antenna, the following instructions are recommended:

- The antenna should be mounted on sheet metal (ground surface/plane) supplied. A metal roof is preferred, the antenna should still function if the ground plane is fitted to a plastic/fiberglass roof. The antenna includes two functions:
  - GNSS (GPS) required for vehicle location, which is dependent on receiving satellite signals from overhead
  - GSM (cellular) required for ‘phone’ communication, which is dependent on a clear line of sight from ground towers, for example: ‘horizontal’ transmission path. Hence a repositioned antenna needs to take these requirements into account and should be positioned on the highest possible packaging location, avoiding depressions wherever possible
- The ground surface does not require any further grounding to the vehicle, it provides a reflective surface rather than acting as a grounding element
- Suitable fixings and sealing are required to secure the ground plane to the roof panel, for example 4x rivets
- The antenna base design/mounting requires a specific hole shape to ensure anti-rotation and orientation.



Item	Description	Item	Description
1	20°	X	Front of vehicle direction

- The mounting on the antenna (shark-fin variant) will accommodate sheet metal thicknesses from 0.7mm to 1.5mm
- The GSM antenna family requires a **minimum** of a 150mm radius uninterrupted metallic ground surface area surrounding the mounting hole. No interruptions are allowed
- The antenna must have a **minimum** clearance of 250mm from any other antenna located on the vehicle roof
- The antenna must have a **minimum** clearance of 250mm from any metallic structures above the ground plane (if present)
- The antenna should be as close to horizontal as possible and must not be at an angle of greater than 12º to the horizontal
- The antenna is attached to the ground surface with a driven fastener from the underside of the plane. The fastener is a captured component on the antenna base
- Cabling needs to utilize RG58LL type cable as provided for each functional band with USCAR FAKRA-type SMB connectors, unless stated otherwise by the customer

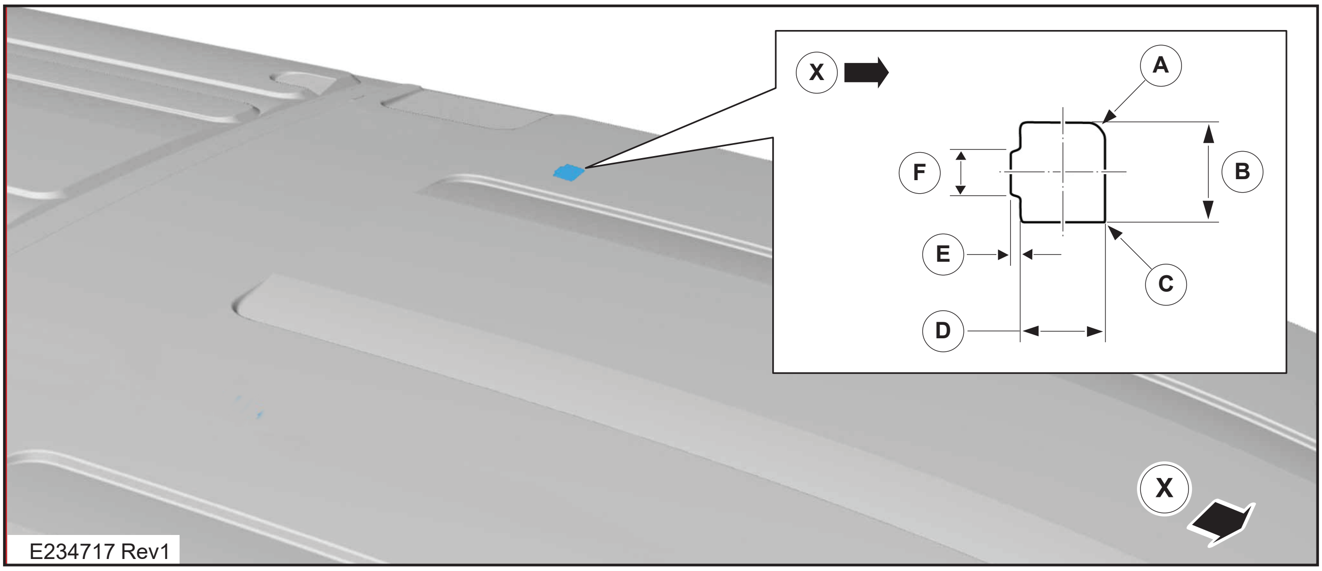
The Vehicle Convertor will need to create vehicle specific versions that meet the requirements previously mentioned in this section. A full range of reception tests will need to be conducted by the Vehicle Convertor to ensure system performance.

Splitter (KK3V-18812-AE) is used when the base vehicle has a scarab (KK3T-19C175-A*). An antenna for GNSS and new Shark Fin (GJ5T-19K351-AB) will be fitted to the conversion for GNSS.

If it is unavoidable and necessary to move the antenna, the following instructions are recommended:

- Provide a minimum clearance of 50mm from all electronic (powered) devices and any wiring harness
- When mounting the antenna, place it on sheet metal at the highest possible metallic packaging location
- The antenna base design/mounting requires a specific hole shape to ensure anti-rotation and orientation (figure E234717 Rev1). The roof and the position on the roof shown in figures E234717 Rev1 and E223923 Rev1 are exemplary only
- The antenna requires a minimum of 150mm radius uninterrupted metallic ground surface area surrounding the mounting hole
- The antenna must be at least 250mm from any other antenna located on the vehicle roof and from any metallic structures above the ground plane (if present)
- The antenna must not sit at an angle greater than 12º to the horizontal
- The antenna is attached to the vehicle with a driven fastener from the bottom side of the metallic ground plane. The fastener will be a captured component on the antenna base
- The antenna pigtail cabling needs to utilize RG174 type cables for each functional band with USCAR FAKRA-type SMB connectors, unless stated otherwise by the customer
- A body side cable is required to use 1.5DS-QFB cable for GNSS or RG-58LL cable for cellular
- The cable length between the Audio Head Unit and the antenna should not exceed 6m to meet required system RF performance
- A full range of reception tests will need to be conducted by the Vehicle Convertor to ensure system performance

Antenna Anti-Rotation Mounting Hole



Item	Description
A	4mm Radius
B	19.8mm (+0.3)
C	7x 1mm Radius
D	16.8mm (+0.3)
E	2mm (+0.3)
F	9mm (+0.3)
X	Front of vehicle direction

4.22 Handles, Locks, Latches and Entry Systems

4.22.1 Door Removal or Modification

CAUTION: If an additional third party control system is incorporated into the Ford Locking/Unlocking System the Crash Event Mid Speed Can Signal must be utilized to override the third party control system to trigger a crash unlock feature within the locking system in case of a relevant event.

NOTE: If any modified doors have ajar switches fitted and operating in accordance with the above, the original alarm and interior lighting functions can be maintained.

NOTE: For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact the Body Builder Advisory Service at bbasqa@ford.com.

In the event of the requirement to remove the doors for derivatives requiring no doors, certain circuits will need to be linked to ensure door ajar warnings do not appear on the Instrument Cluster. The interior light will also stay on if this is not done.

It is possible to maintain a certain state by configuring the Body Control Module (BCM) C5 in the following way.

- C5-33 Front Left Ajar - Ground = Door Closed
- C5-21 Front Right Ajar - Ground = Door Closed
- C5-34 Rear Cargo Ajar - Ground = Door Closed. No rear door - i.e. chassis cab or cutaway - Open Circuit = Door Closed
- C5-46 Ajar Left Side Cargo Switch - not connected = Door Closed
- C5-19 Ajar Left Side Cargo Switch - not connected = Door Closed

4.22.2 Central Locking

NOTE: Each unlock circuit supports 1 production type Latch. If more than 1 latch needs to be fitted, additional relays will need to be used (max 300mA coil current permitted) per unlock circuit.

NOTE: All latch lock and unlock pulse durations are 110ms.

Locking is controlled by the BCM. There is current sensing on certain locking circuit pins as part of the security system – if these are tampered with, locking performance cannot be guaranteed. However, it is possible to add additional lock(s) via relays (max 300mA coil current permitted) per unlock circuit. All latch lock and unlock pulse durations are 110ms.

The use of Ford Transit lock mechanisms is strongly recommended as the BCM is designed to drive these latches for the correct amount of time.

See also: 4.24 Electrical Connectors and Connections and **4.18.3 Third Button on Key Fob**, later in this section, for more locking interface options.

Locking Configurations The following list details specific locking scenarios that have been noted by customers:

1. Raid locking or drive away locking for taxi and parcel van usage – higher security configuration for business use.
2. Slam locking – this is a configurable parameter in the BCM (dealerships can only switch off this feature, but not switch on).

4.22.3 Third Button on Key Fob - Single Chassis Cab

NOTE: There are no micro switches, no current sensing, or any alarm system functionality associated with this pin, or any lock set driven by it.

C3-31 on the BCM is controlled by the third button on the key fob. This provides a 12V 110ms pulse when pressed. The signal can be used via an external relay for a variety of convertor applications, subject to load required.

The locking circuits are powered by solid state drivers in the BCM. The lock circuits have output protection that will switch the output off if a short circuit is present. The fault must be removed to reactivate the output.

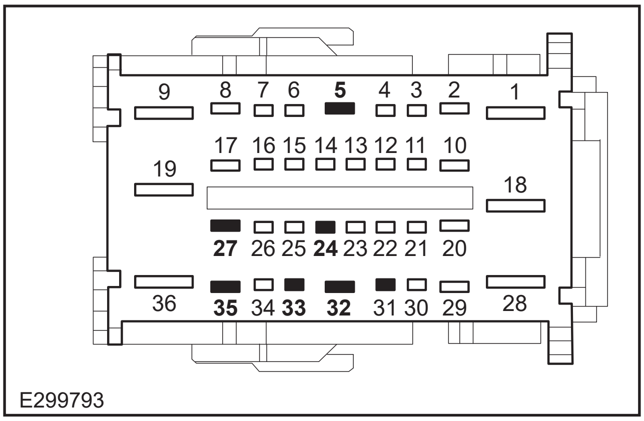
BCM	14A631 in-line Drive Side	14A631 in-line Passenger Side	Function
C3-35	A16	A16	Central Lock
C3-27	A17	-	Driver's Door Unlock
C3-05	-	A17	Passenger Door Unlock

BCM	19L540	Function
C3-24	1	Unlock RH Sliding Door (non PSD)
C3-33	1	Unlock LH Sliding Door (non PSD) or Unlock PSD LH/RH

PSD= Power Sliding Door

BCM	13A409	Function
C3-31	6	Unlock Cargo

Pins to Control Additional Door Locks



Item	Description
C3-05	Passenger Door Unlock
C3-27	Driver's Door Unlock
C3-24	Unlock RH Sliding Door (non PSD)
C3-35	Central Lock
C3-33	Unlock LH Sliding Door (non PSD) or Unlock PSD LH/RH
C3-31	Unlock Cargo

4.22.4 Remote Keyless Entry/ Tire Pressure Monitoring System Receiver (RKE/TPMS Receiver)

⚠ **WARNING: For best performance, the RKE/ TPMS receiver must be a minimum distance of 1" (25mm) away from any metal objects and 3.9" (100mm) away from high switch loads.**

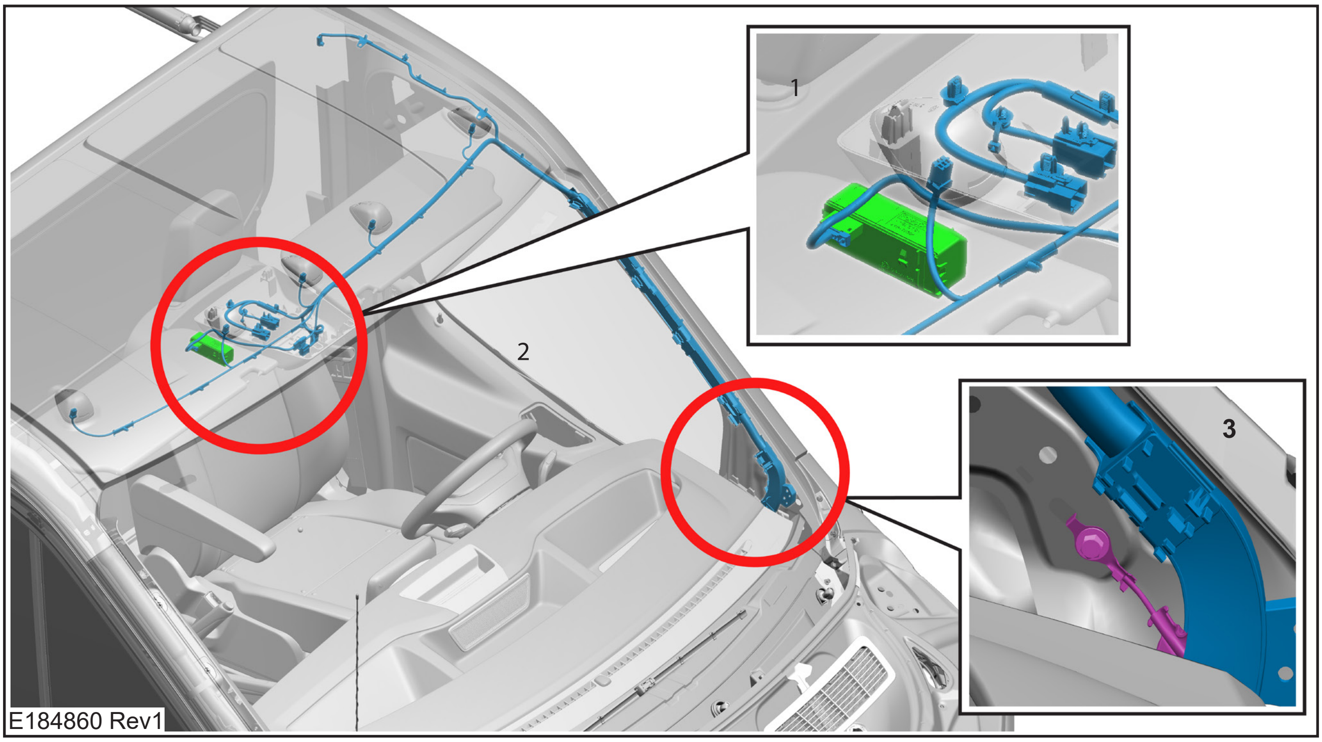
NOTE: It is recommended that the RKE/TPMS has a dedicated ground wire and ground stud, do not splice with other modules.

NOTE: If the RKE/TPMS reciever is removed during an upfitting/conversion process, the backup slot/ pocket must be used to start the vehicle. To locate the backup slot, refer to your vehicle Owner's Manual.

The RKE/TPMS receiver is fed via a connection to the 13A409 harness and then grounded at the ground point located on the 'A' Pillar.

For ground point locations
Refer to: 4.25 Grounding
For additional information
Refer to: 2.4 Wheels and Tires

Remote Keyless Entry/Tire Pressure Monitoring System Receiver



Item	Description
1	RKE/TPMS Receiver
2	Harness 13A409
3	Ground Point Location

4.23 Fuses and Relays

4.23.1 Fuses

⚠ **WARNING: No increase in existing vehicle standard fuse capacity is allowed under any circumstances. There are no spare fuses in the Engine Junction Box (EJB), Standard Relay Box (SRB) or Body Control Module (BCM). The vehicle modifier must provide additional fuses as required. Please refer to Ford Fuse table in this section.**

NOTE: Only use Ford fuses as shown in table below. Other fuses may interfere with the validated fusing strategy.

Ford Fuses

Ampere Rating	Color
Mini Fuse	
2A	Gray
3A	Violet
4A	Pink
5A	Tan
7.5A	Brown
10A	Red
15A	Blue
20A	Yellow
Midi Fuse	
60A	Yellow
J-Case Fuse	
20A	Blue
30A	Pink
40A	Green
50A	Red
60A	Yellow

4.23.2 Relays

NOTE: Only use Ford Relays shown in table.

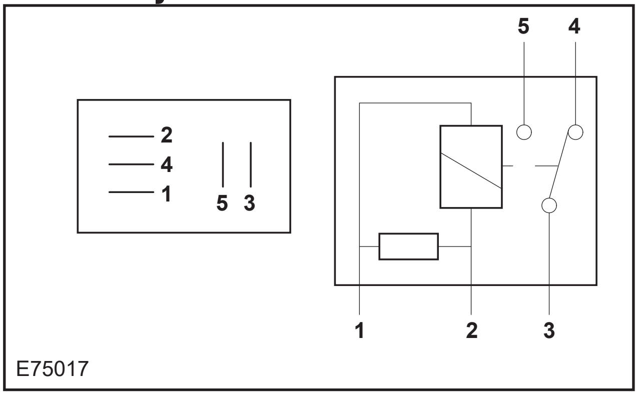
Ford standard relays have a nominal coil current of 300mA (max) at 77F (25°C). Relays with higher loads should not be used.

For maximum switching currents please refer to Relay Figures E75017 and E75018.

Ford Relays

Ampere Rating	Color
Mini Relay	
70A	Gray
40A	Black
40A	Black
Micro Relay	
20A	Black
20A - Silent/Low Noise Relay	Gray

Micro Relay

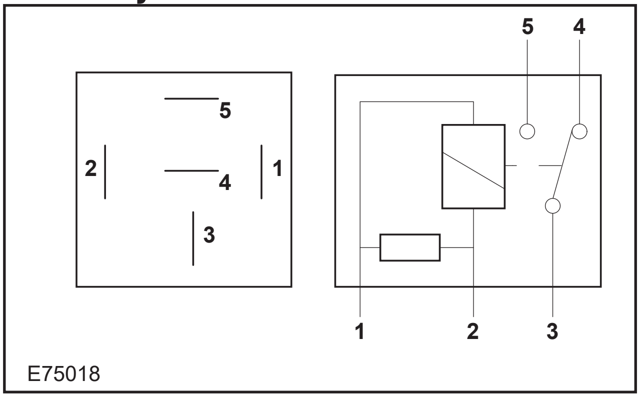


Micro Relay Parameters	
Open contacts	20 Amps
Closed contacts	16 Amps
Nominal coil current	300 mA (max)

Medium current changeover relay - Part number: 6G9T-14B192-B*

Medium current normally open relay - Part number: 6G9T-14B192-A* (pin 4 not present)

Mini Relay



Mini Relay Parameters	
Normally open contacts	40A
Normally closed contacts	20A
Nominal coil current	300mA (max)

Medium current changeover relay — Part number: 6G9T-14B192-D*

Medium current normally open relay — Part number: 6G9T-14B192-C* (pin 4 not present)

4.24 Electrical Connectors and Connections

4.24.1 Connectors

Cutting into the Original Wiring System

WARNINGS:

⚠ **Under no circumstances should the CAN Bus be tampered with. This may lead to failure of safety critical components such as Anti-Lock Brake System.**

⚠ **Do not use connectors which cut through the outer covering and into the core wire.**

ⓘ **CAUTION: Only use Ford approved connectors.**

NOTE: Ford approved jumper harnesses should be used

It is not recommended to cut into vehicle wiring because:

- The base vehicle specification is unsuitable for incremental loads except in conjunction with Auxiliary Fuse Panel
- Long term risk of a faulty connection developing
- Potential fire risk from over-loading

All connections into existing wiring must be permanently insulated. Exterior connections must be waterproof and with a drip loop.

Where wires are required to be extended, break in points should only be at existing connector points. If splicing into existing wiring is unavoidable, see wiring splicing procedures in this manual.

Refer to: 4.2 Wiring Installation and Routing Guides

4.24.2 Vehicle Interface Connector

WARNINGS:

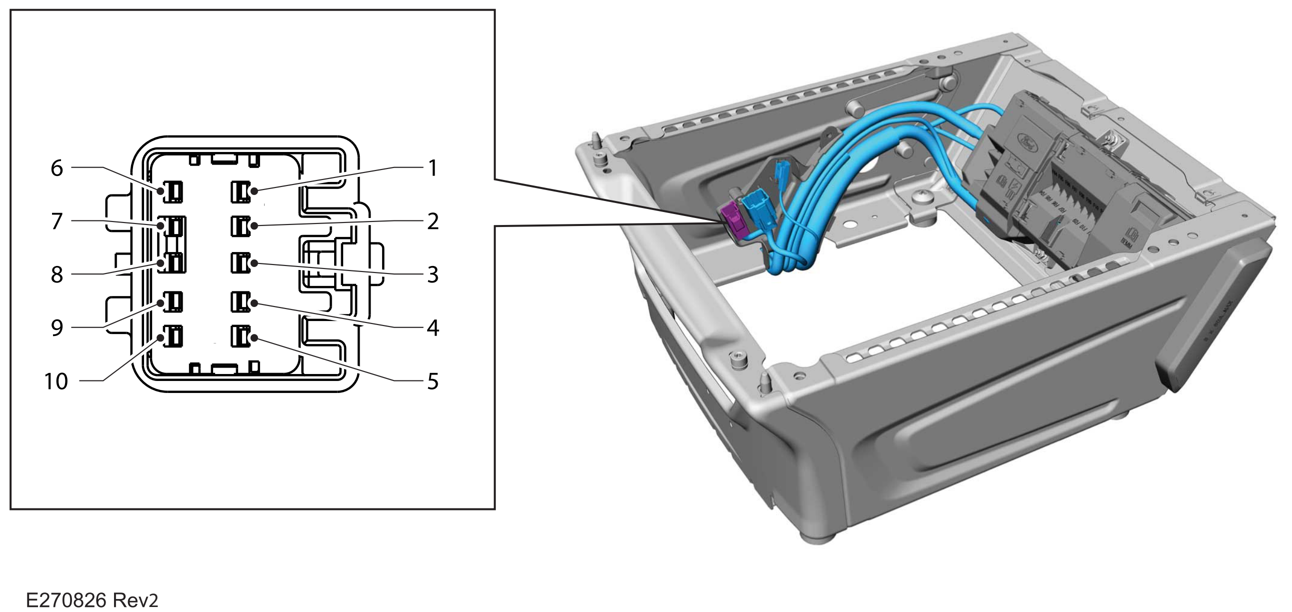
⚠ **Signals 3 to 5 on the Vehicle Interface Connector are for sensing purposes only and not to be loaded by high current consumers. The max current rating for signal 6 is 10A and signal 8 is 15A. These are not to be exceeded in any situation.**

⚠ **Unused wires in the service kit must have cable ends insulated to avoid shorting on any ground points.**

NOTE: The Vehicle Interface Connector is on every vehicle and provides a direct interface to useful signals.mating connector to access these signals, and 3m of wiring.

NOTE: Vehicles Built after November 2019 will have the 10 way connector. See figure E270826 Rev2 for location and the following table for signals.

Vehicle Interface Connector C33-E



10 Way Connector			
1	Ground	6	Ignition
2	Engine Run	7	Switch Illumination
3	SRC Inhibit	8	12V+ KL30 (15A)
4	Load Shed Ground In	9	Load Shed Ground Signal Out
5	Vehicle Speed Signal	10	Blank

Vehicle Speed

Square Wave Characteristics

Specifications	
Max High Signal	Battery Voltage
Min High Signal	3.67 Volts
Max Low Signal	1.1 Volts
Min Low Signal	- 1.1 Volts
Max Ground Offset	± 1.0 Volts
Rise Time	10μ sec <= tr <= 250μ sec
Fall Time	10μ sec <= tf <= 250μ sec
Duty Cycle	50% ± 10%
Pulse Rate	2.2 Hz/MPH (1.3808 Hz/KPH)

WARNING: Do not interface with the CAN (Controller Area Network) for vehicle speed.

Pin 5: Vehicle Speed signal is a direct current coupled square wave that varies in frequency in proportion to vehicle speed. This provides a square waveform (50% duty cycle) signal, where a frequency of 138Hz equates to 62mph (100km/h).

Ignition

Pin 6: Ignition signal is protected by a 10A fuse. It is +12V active at ignition positions: Accessory (1) and Run (2). It is not active at Ignition Off (0) or Crank (3). Whilst it can drive equipment directly it is recommended to use this feed to control a convertor fitted relay, especially for high current applications.

Switch Illumination

Pin 7: Switch Illumination signal is only to be used for sensing or to control a relay. It is +12V for: side lights, dipped, full beam and auto light mode (when lights are on) at switch positions. A daytime running lamp vehicle will still need to have the light switch to control this signal.

Engine Run

WARNING: Do not cut into the alternator wires or use the alternator as a source to obtain a 'D+ Signal'.

Pin 2: Engine run signal will only support a sense line or relay control that is in **AND** logic with the load-shedding signal.

This engine run signal is ground switching (max current sink 250mA), it provides no positive output (open circuit) and is only active when the engine is running.

The signal will not be present when:

- Key states - Off (0), Accessory (1), Run but Engine Off (2), Crank (3)
- Engine running but load is greater than 250mA (driving two or more relays in error)

The load-shedding 10A ground signal must be used for power control.

Pin 4: Load-shedding with Battery SOC Protection switched ground signal is a signal that must always be the primary controlling signal to be used to handle third party loads totalling over 60A.

Refer to: 4.6 Battery Protection

The engine run feature can only be used to control power if the load-shedding signal has overall control, for example through a power relay.

Engine run can be used for other systems such as telematics and data loggers. This feature will supply power at engine run, and at engine off it will isolate when the battery reaches the timer or SOC value. At engine run, the signal will extinguish if voltage drops to below 11V. This is to protect critical systems such as EPAS. The voltage of the system should not drop below 13V for continuous periods. If this occurs, the extra equipment added, is exceeding supply and supplemental energy sources may be required, such as additional alternators.

4.24.3 Auxiliary Fuse Panel (JZGAE)

The Auxiliary Fuse Panel is recommended for Vehicle Convertors where access to fused power connections are required (for example, additional lighting).

The Auxiliary Fuse Panel is located behind the glove box and slightly outboard behind the removable cup holder. The main power is supplied by a 150A fuse in the high current fuse panel, located in the driver's seat pedestal.

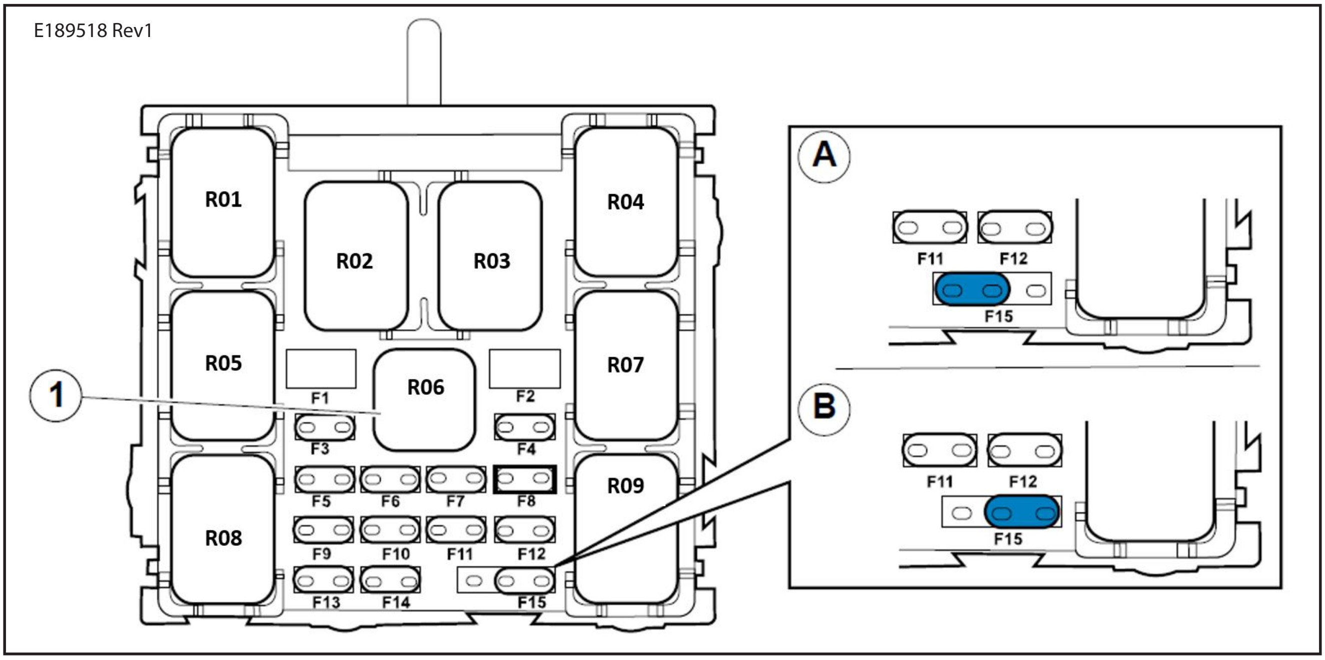
Critical signals are obtained from the standard interface connector. If the signals are still needed for other third party add-on systems, the fuse panel comes with a cloned standard interface connector, packaged slightly higher in the driver's seat pedestal.

The Auxiliary Fuse Panel uses the Vehicle Interface Connector, shown in figure E292812, and provides an advanced customer access point (C1) connector as well as a (C2) interface connector to further switch installations and a power and ground supply.

There are 4 relays that can be controlled via third

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Auxiliary Fuse Panel



Item	Description
A	Ignition Only position of F15
B	Permanent Power Only position of F15
1	Diodes (1A rated)*

* Ensure that you orientate the diodes to the diagram above otherwise they will not work

Item	Description	Item	Description
F1	40A Fuse	F14	5A Fuse
F2	40A Fuse	F15	3A Fuse
F3	20A Fuse	R1	20A Relay (Beacon(1))
F4	20A Fuse	R2	40A Relay (Aux1 power)
F5	10A Fuse	R3	40A Relay (Aux2 power)
F6	3A Fuse	R4	20A Relay (Ignition)
F8	10A Fuse	R5	20A Relay (LHS Indicator)
F9	15A Fuse	R6	Ultra micro relay. Ground to set Third Party High Power mode when Beacon Switch is ON
F10	5A Fuse	R7	20A relay (Interior light)
F11	5A Fuse	R8	20A Relay (RHS Indicator)

(1) When specified on Ford options
Any pin/fuse not listed in the table above are not to be used.

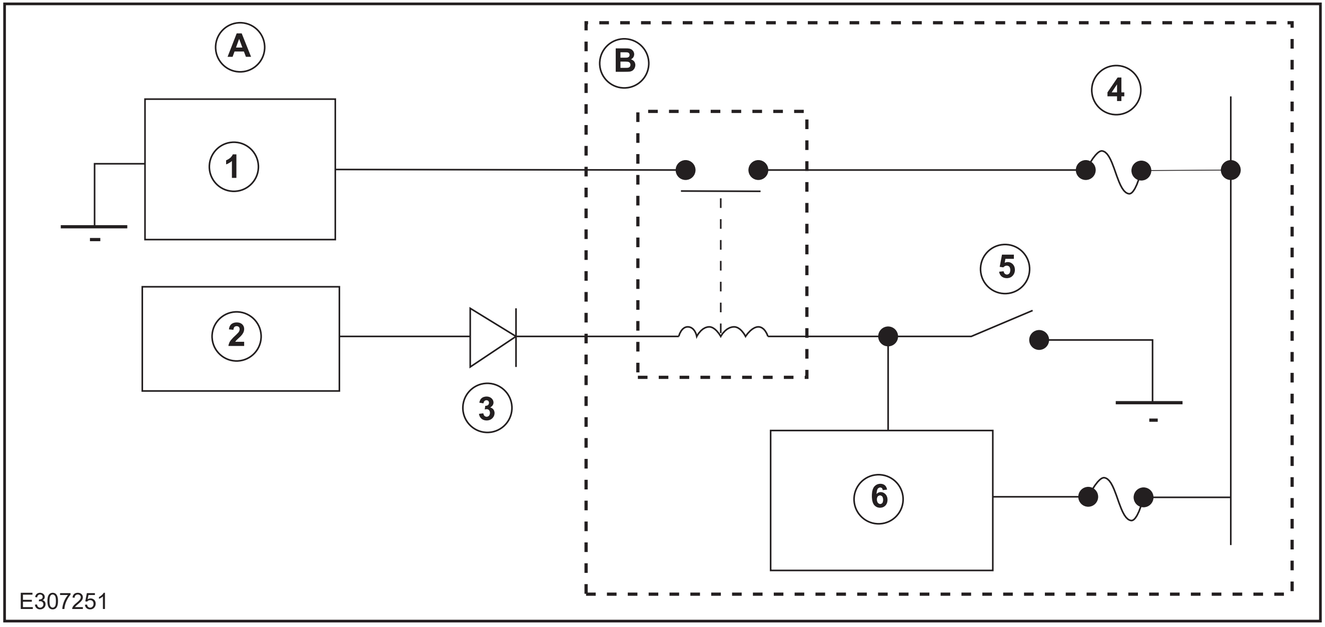
party input switches (when ordering the stand alone fuse panel). Two of the outputs can switch 40A per circuit.

Features

- The fuse panel comes from production, 'powered at ignition position 2' only and not 'powered at all times'. This is to avoid any discharged batteries during the shipping and conversion process. Once switched and peripherals are added, the fuse panel can be configured to 'powered at all times' by the jumper fuse relocation from position A to B, as shown in figure E189518 Rev1. It is recommended to change to the permanent power mode after the third party equipment has been added and near the end of the total conversion.
- In the Auxiliary Fuse Panel, all switched relays are

]

Recommended Third Party Switch Interface to Aux Fuse Panel



Item	Description
A	Third Party Fit System
B	Fuse Box Sub-System
1	Third Party Device to Power
2	Third Party +12V Input
3	Recommended To Add a Diode to the 12V Input Feed to Avoid a Back Feed Sneak Path
4	Fused Supply to Contacts
5	Load Shedding Ground
6	Other Auxiliary Fuse Panel Relays

now controlled via the 'load shed' signal, which also functions as a 'battery guard' feature at 'engine off'. There are no 'engine run' controlled signals. If 'engine run' control is added, it must be '**AND** logic', not '**OR** logic' with the 'load shed' system. Even when 'engine run' control is required, the total vehicle third party system load must not exceed 60A. This total includes use of CCP1.

- At 'engine off', under SBG control, the BCM provides the following timers and SOC values before disconnect. The timer resets each 'ignition on' and in 'engine run'.
  - For a single battery and non-AGM, 30 minutes activation limit and 60% SOC limit.
  - For a twin AGM battery (in vehicle configuration) the timeout is 75 minutes and SOC limit is 40%.
- If the Third Party High Power mode feature is activated, the timeout on the SBG is suppressed so the system will isolate only on the battery SOC limit.

Refer to: 4.6 Battery Protection

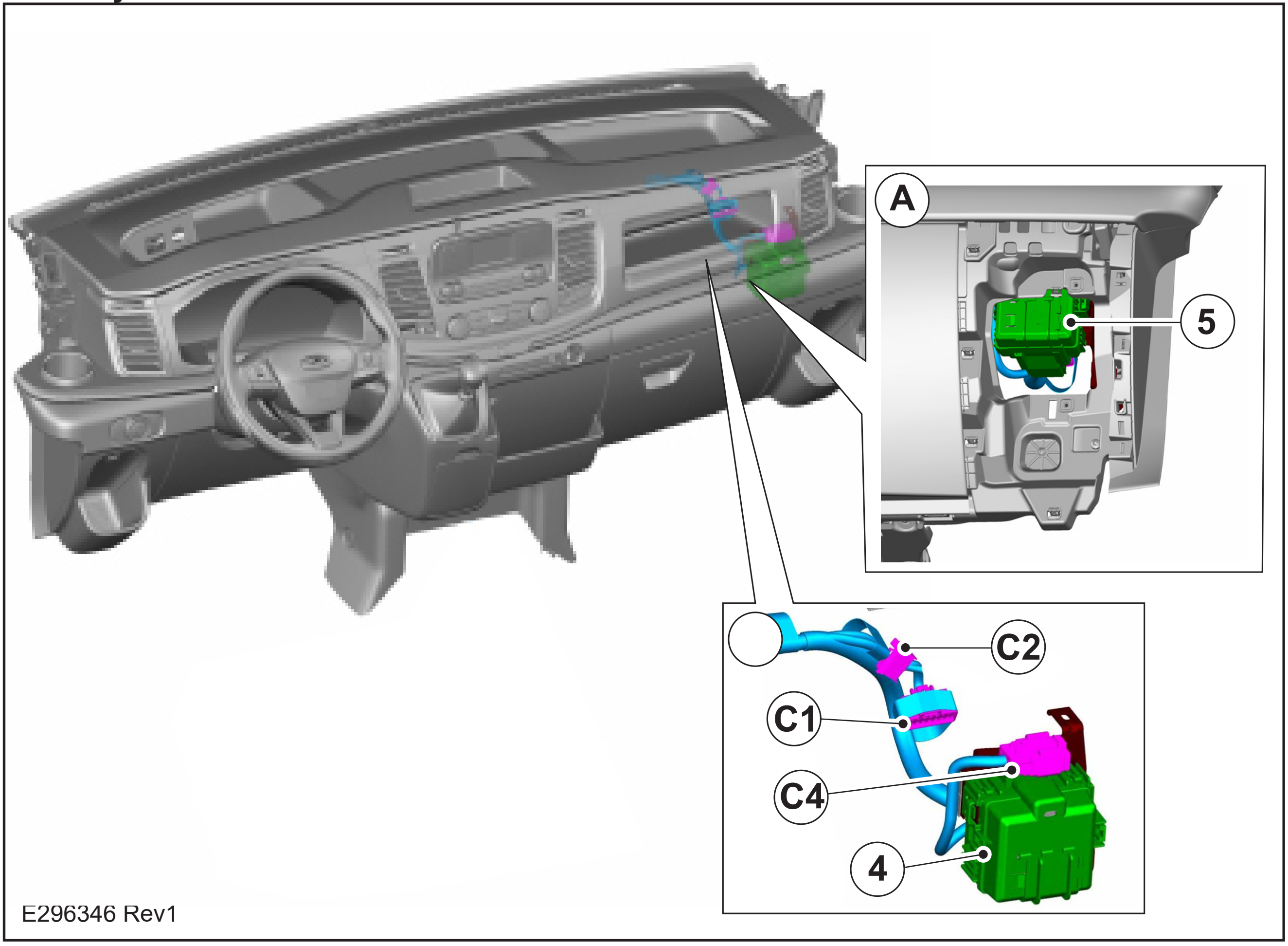
- The Auxiliary Fuse Panel outputs, controlled by 'load shedding', and excluding the relay driven direction indicators, may switch off at engine 'drive run' mode in the event of a low voltage (11V). This is designed to protect EPAS which is now standard on the Ford Transit. If the system is continuously reaching this low voltage, there may be an issue with the energy sources or the third party system demand is greater than the supply. System voltage should not drop below 13V for continuous periods. Check that each system's energy supply is compatible with the add on third party equipment and Ford system demands.
- There is a dedicated 40A output connection, separate to the C1 and C2 traditional connectors. This is mounted onto the fuse box housing.
- The 43-way interface connector (when ordering A608) is also mounted to the fuse box housing.
- The 10-way standard interface connector, shown in figure E292812, is cloned nearby and is located in the driver's seat area. Extra signals for third party equipment can be obtained from here with the same dealer service kit.

Refer to: 4.6 Battery Protection

- The Auxiliary Fuse Box is fed from a 150A fuse F06, in the driver's seat pedestal, high current fuse panel, with the control grounds from the battery ground stud. If this fuse is an open circuit, then a complete fuse assembly is required.

- The SBG signal in the standard interface connector (cloned pin 3) must be used to control a third party relay (non-latched normally open type) if the CCP2 cannot be utilized and more than 60A is required.

Auxiliary Fuse Panel

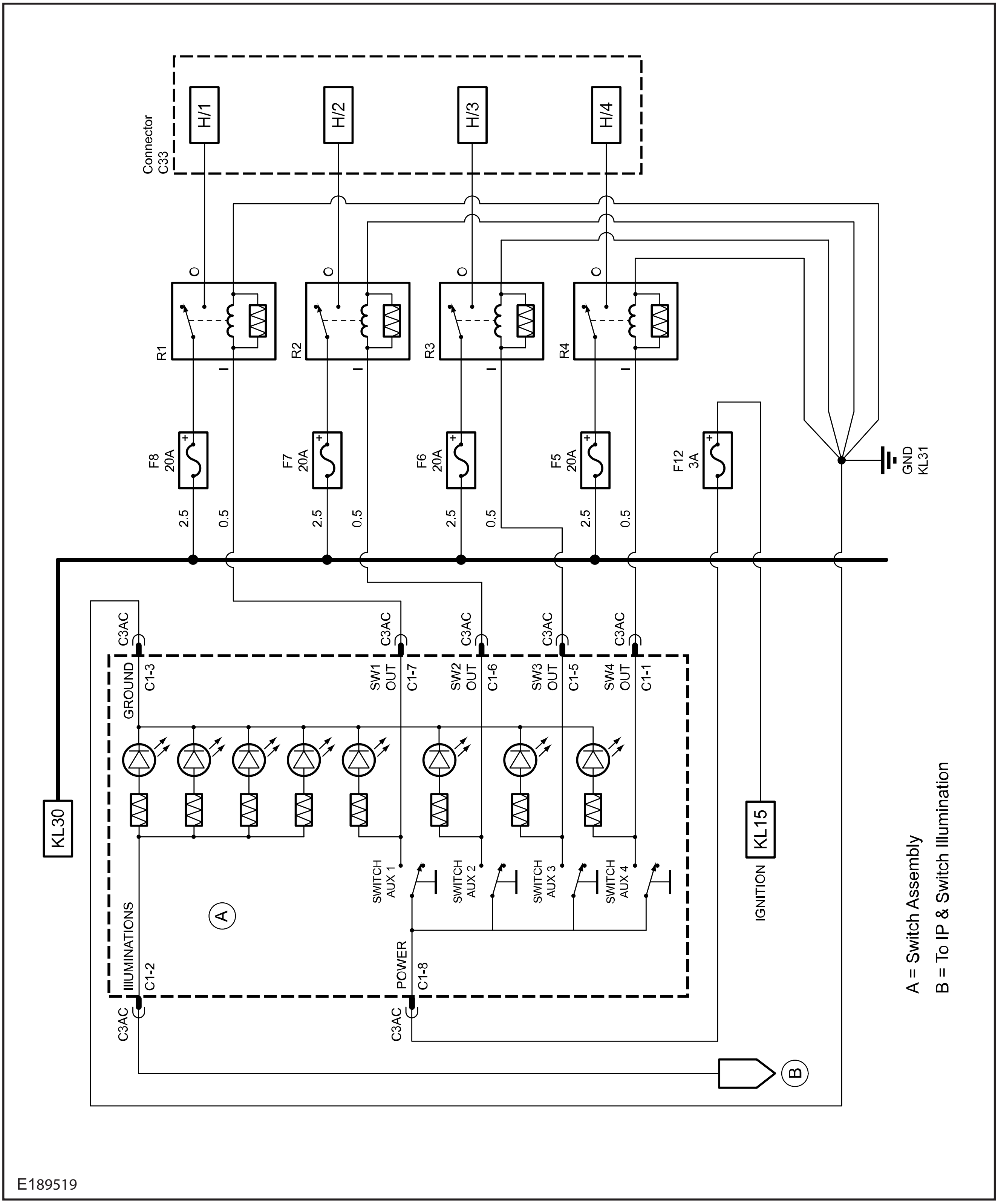


E296346 Rev1

Item	Description
A	For better visibility of F15 location remove the cup holder
B	Access through the glove box for connectors and Auxiliary fuse panel
C1	Connector 1
C2	Switch Connector
C4	Connector 4
4	Auxiliary Fuse Panel
5	Auxiliary Fuse Panel access lid

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Auxiliary Fuse Panel Circuit Diagram (key overleaf)

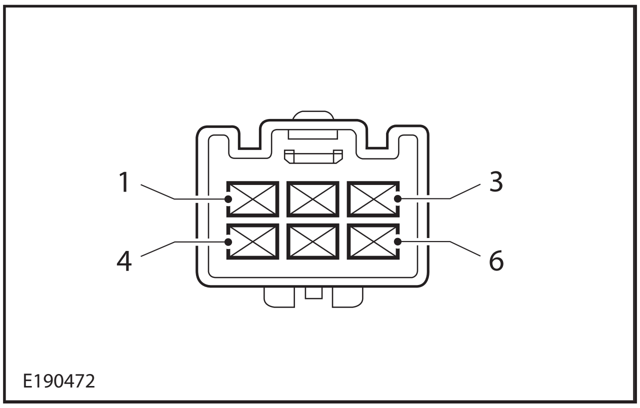

Connector C33
H/1
H/2
H/3
H/4
R1
R2
R3
R4
F8 20A
F7 20A
F6 20A
F5 20A
F12 3A
GND KL31
2.5
0.5
KL30
C3AC
GROUND C1-3
SW1 OUT C1-7
SW2 OUT C1-6
SW3 OUT C1-5
SW4 OUT C1-1
SWITCH AUX 1
SWITCH AUX 2
SWITCH AUX 3
SWITCH AUX 4
A
IIIUMINATIONS C1-2
POWER C1-8
KL15
IGNITION
B
A = Switch Assembly
B = To IP & Switch Illumination
E189519

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Auxiliary Fuse Panel Circuit Diagram Key				
Fuse No.	**Type**	**Value (A)**	**Color**	**Function**
F1	Mcase	40	Orange	R2 Power
F2	Mcase	40	Orange	R3 Power
F3	Micro	20	Yellow	R1 Power
F4	Micro	20	Yellow	R4 Power
F5	Micro	20	Yellow	R5 Power
F6	Micro	-	-	Spare
F7	Micro	-	-	Spare
F8	Micro	20	Yellow	R7 Power
F9	Micro	20	Yellow	R8 Power
F10	Micro	-	-	Spare
F11	Micro	-	-	Spare
F12	Micro	20	Yellow	R9 Power
F13	Micro	5	Yellow	R6 Feed
F14	Micro	5	Tan	Ignition KL15
F15	Micro	5	Tan	R6 Power
Relay No	**Type**	**Value (A)**	**Relay Name**	
R1	Power Relay	20	Aux Power 1	
R2	Power Mini ISO	40	Aux Power 2	
R3	Power Mini ISO	40	Aux Power 3	
R4	Power Relay	20	Aux Power 4	
R5	Power Relay	20	Aux Power 5	
R6	Ultra Micro Relay	20	Feeds Aux Switch Panel	
R7	Power Relay	20	Aux Power 5	
R8	Power Mini ISO	20	Aux Power 5	
R9	Power Mini ISO	20	Aux Power 5	

Any pin/fuse not listed in the table above is not to be used

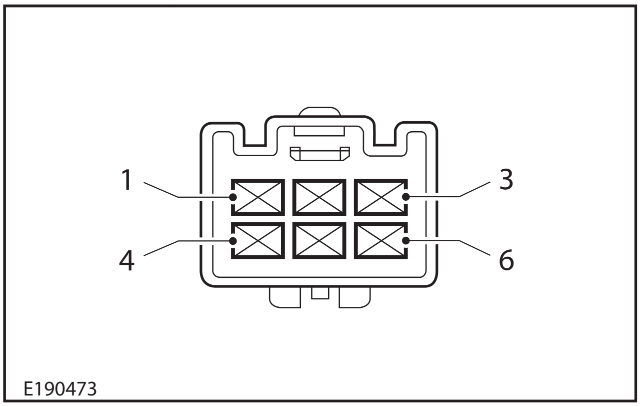
C33-C Connector



E190472

Item	Description
1	Ground - Cowl Side Pillar
2	Not Used
3	Fuse 26 (Modified Vehicle Wiring) VBATT (40A)
4	Not Used
5	Relay 59 (Modified Vehicle Wiring) VPWR (40A)
6	Fuse 41 (Upfitter Connector) VBATT (40A) Battery Fused Feed

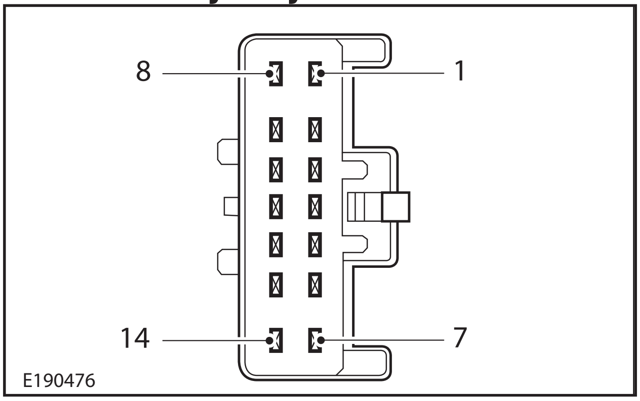
C12-A Connector



E190473

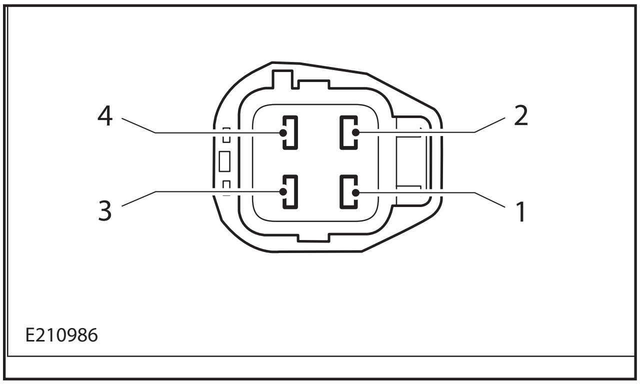
Item	Description
1	Upfitter Customer Access Pass Thru
2	Upfitter Customer Access Pass Thru
3	Fuse 26 (Modified Vehicle Wiring) VBATT (40A) Battery Fused Feed
4	Fuse 59 (Modified Vehicle Wiring) VPWR (40A) Run/Start Fused Feed
5	Front Left Lamp Turn
6	Front Right Lamp Turn

C33-D Cutaway Body Connector



Item	Description
1	Fuse 24 (Upfitter Connector) (10A)
2	Audio Speaker R-Rear
3	Audio Speaker R-Rear
4	Entry Illumination Rear
5	Leaf Rear Door Ajar
6	Fuse 32 Interior Lighting
7	Passenger Door Lock
8	Fuse 5 (20A)
9	Audio Speaker L-Rear
10	Audio Speaker L-Rear
11	Not Used
12	Not Used
13	Not Used
14	Right Rear Door Ajar

C11-H Connector



Item	Description
1	Fuse 59 (Modified Vehicle Wiring) VPWR (40A) Run/Start Fused Feed
2	Upfitter Customer Access Pass Thru_1
3	Upfitter Customer Access Pass Thru_2
4	Fuse 26 (Modified Vehicle Wiring) VBATT (40A)

4.24.4 Customer Connection Points

WARNINGS:

Before connecting to the vehicle you must remove the main vehicle ground to isolate the 12V system.

Only use the Ford approved kit for adding fuses to the CCPs.

DO NOT connect the same load to both CCP1 and CCP2. The system is not designed to work together as the fuses have different values.

CAUTION: When connecting to the CCP, it is recommended to disconnect the battery ground so as to avoid a short circuit. The fixing torque for CCP1 (M5) is 2.6-3.6 ft lb (3.5–4.5Nm) and for CCP2 (M8) is 8.85 ft lb (12Nm).

NOTE: When fitting additional power wiring feeds the protective cover will need to be revised to allow routing for the extra wires. The cover is pre marked with the relevant areas so that they can be easily removed.

NOTE: There is a maximum of two CCPs. These points are always located on the driver's seat pedestal and are protected by a cover. CCP1 which is capable of supplying a max current of 60A and CCP2 which is capable of supplying a max current of 175A.

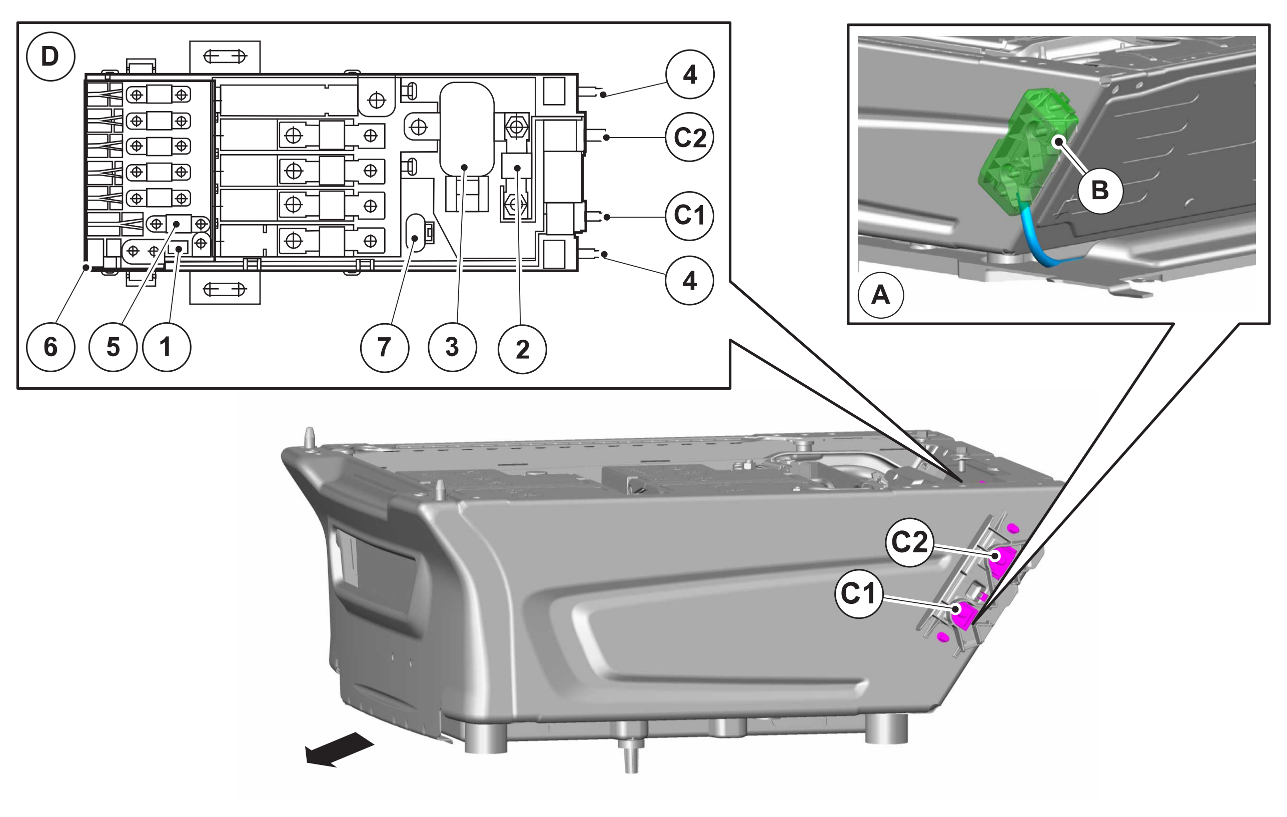
NOTE: Most vehicles with single battery will not have CCP2. Only those vehicles with twin batteries or certain SVO options with will have CCP2, check with your local Ford dealer for details. If CCP2 is required then order kit KU5T-14D089-B*.

NOTE: CCP2 follows the Standard Battery Guard [SBG] function. Refer to: 4.6.2 SBG and Load Shedding -Functionality for functional behavior

NOTE: Before removing the CCP cover, move the driver's seat pedestal forward to provide sufficient access, avoiding the need to remove any body trim.

For high current supply and ground connections Refer to: 4.5.9 Single and Twin Battery Systems

CCP Location and Pre Fuse Panel



E291635

Item	Description
A	Suggested wiring location
B	CCP Cover
D	Pre Fuse Panel
C1	CCP1 (60A)
C2	CCP2 (175A)
1	60A fuse - supplies CCP1, High Specification Interface Connector (A608), Camper
2	175A fuse - supplies CCP2
3	CCP2 Load-shedding, and Standard Battery Guard (SBG) Relay
4	CCP cassette fixing studs (NOT to be used as grounding points)
5	150A SVO Auxiliary Fuse Panel feed
6	If any of the fuses in this area have failed this section of the Pre Fuse Panel will need replacing. Please contact BBAS@ford.com for service kit number.
7	Park position for relay connector control when single battery donor

4.24.5 High Capacity Auxiliary Switches

When the switches are pressed (light on) the switches provide a +12V(20A,20A,40A,40A) output.

NOTE: Aux 1, 2 and 3 switches are Ignition supplied and Aux 4 is Engine Run.

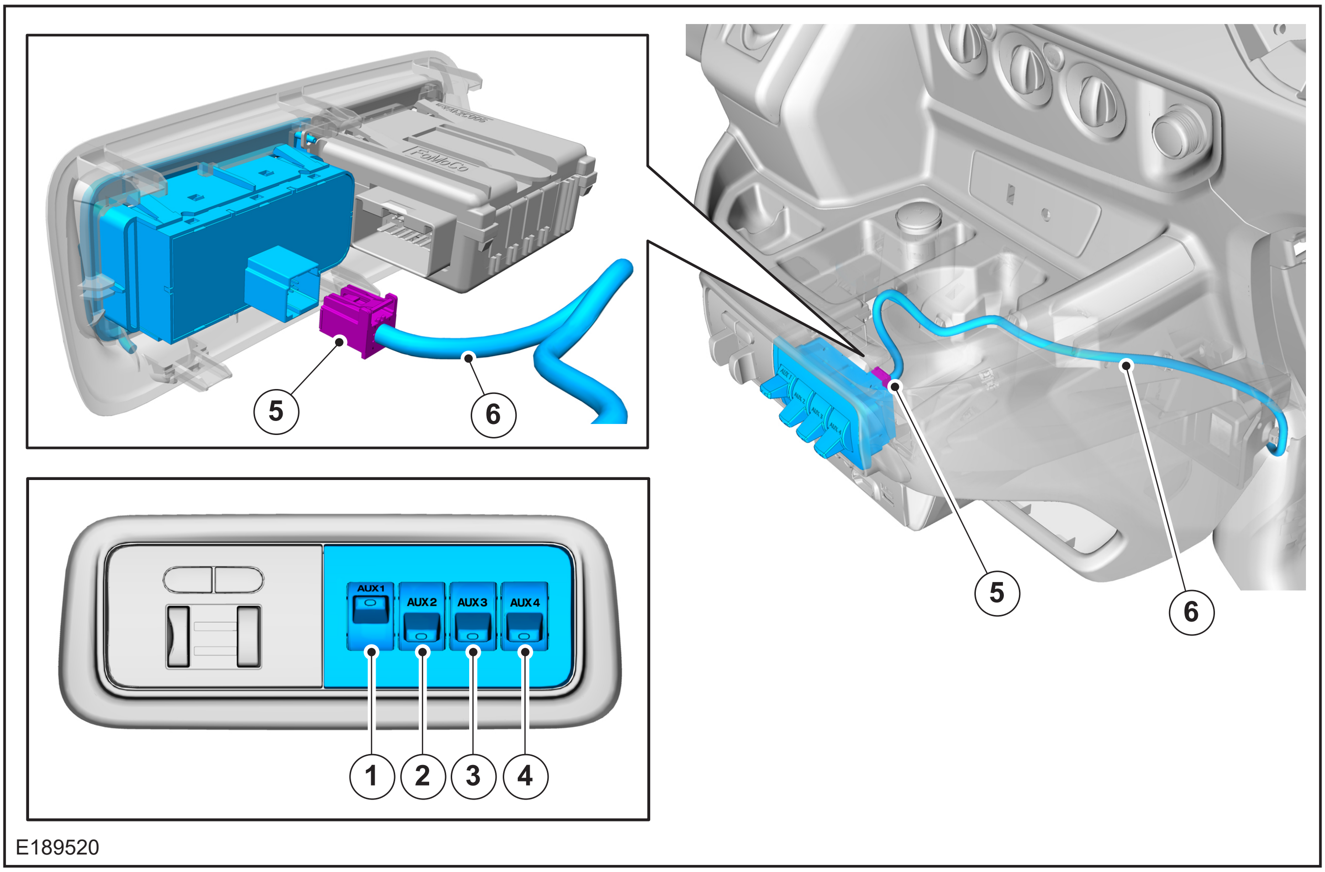
The Aux 1, 2 and Unswitched power outputs (with respective grounds) are located in High Specification Vehicle Interface Connector, see figure E236206 and table. Aux 3 and Aux 4 power outputs (with respective grounds) are located in the C33-H connector behind the glove box, see figure E233939.

If heavy loads are required, controlled via these switches (especially at engine off) it is recommended to order High Performance Deep Cycle AGM batteries on the base vehicle. The switches are illuminated red when the lights are: side, dipped, full beam or auto lights on.

Recommendations: When the switches are configured to hot/live at all times please note the following:

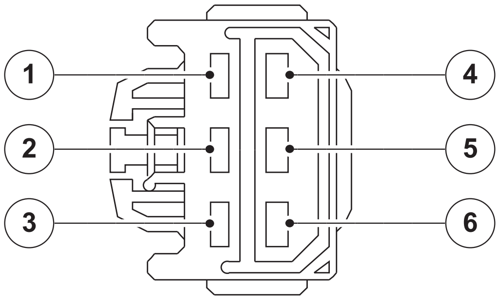
- The peripherals to be controlled by the hot/live at all times switches should be visual/audible systems, such as Beacons, Spotlights
- Covert systems such as Water Heaters and Invertors must be fed from Ignition and Engine Run supplies
- If a system is connected to hot at all times which cannot be detected, visually/audibly, then there is a risk of complete battery discharge and therefore failed start

High Capacity Auxiliary Switches



Item	Description	Current (A)	Comments
1	Aux 1	20	Ignition supplied/Hot at all times
2	Aux 2	20	Ignition supplied/Hot at all times
3	Aux 3	40	Ignition supplied/Hot at all times
4	Aux 4	40	Engine Run
-	Unswitched	20	Ignition Supplied
-	Unswitched	20	Ignition Supplied
5	Auxiliary Switch Pack Connector		
6	14A348 Jumper Harness		

C33-H - High Capacity Auxiliary Switch Output



Pin	Description	Comments	Fuse Number	Fuse Rating	Nominal Rating
1	Ground KL31 (40A max)	-	-	-	-
2	Not to be Used	For EMC	-	-	-
3	Upfitter switch 3 Output (40A max, Ignition Supplied)	for EMC reasons, use Ground Pin 1 in this connector	13	40A	32A
4	Ground	-	-	-	-
5	Not to be Used	For EMC	-	-	-
6	Upfitter switch 4 Output (40A max, Ignition Supplied)	for EMC reasons, use Ground pin 4 in this connector	14	40A	32A

4.24.6 Adding Connectors

Marker Lights

⚠ **WARNING: The Position Marker and Dipped Beam Lights of the vehicle are collectively powered via F11 and F15 in the Body Control Module at a rating of 25A. A nominal current rating of 20A (full load including all potentially fitted additional lights) must not be exceeded.**

- F11 - Dipped Right and Position Left
- F15 - Dipped Left and Position Right

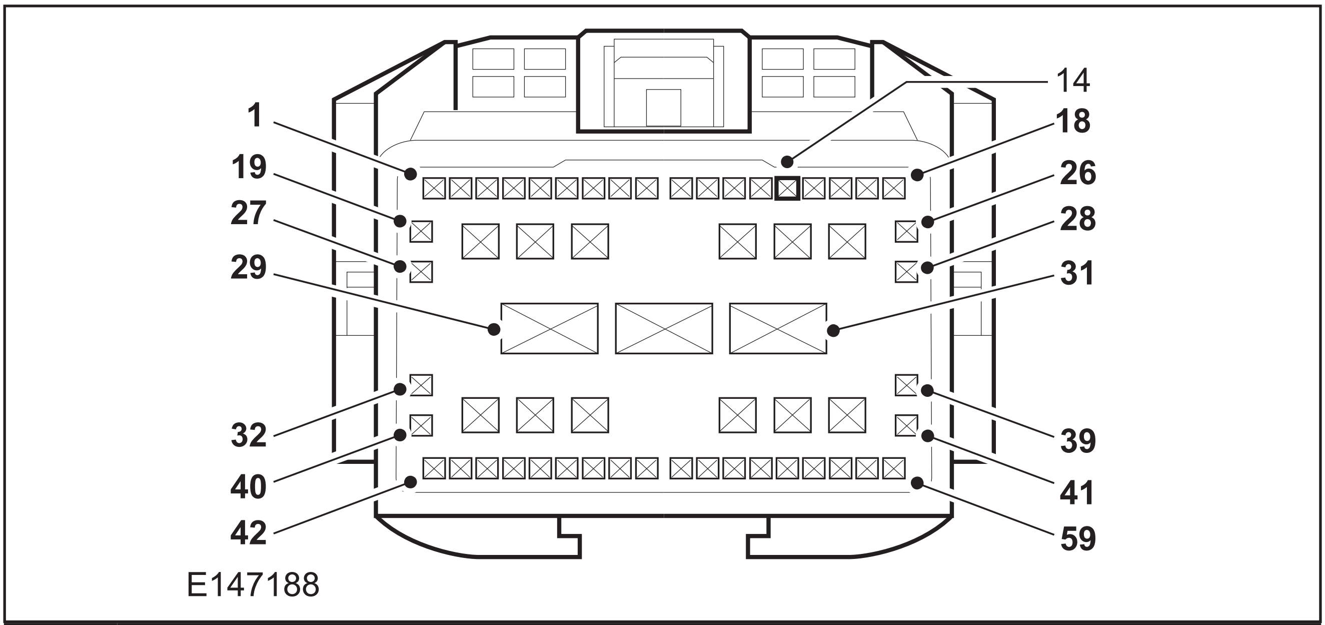
Unused Connectors

The harnesses may have a number of unused connectors – these are dedicated to other features and options, but are not always present depending on level of harness fitted. Ford do not recommend the use of these connectors for any other purpose than that intended by design.

Power Outlet / Cigar Lighter

Both features adopt a 20A fusing strategy. With a single battery system, continued loading of these features will lead to battery drain, and risk vehicle starting. If continuous power is required, a second battery option should be installed and the customer connection points, where fitted, utilized. At engine OFF, all three power outlets are connected to the battery saver system, where the supply will switch off at 30 minutes.

Marker Lights



Item	Description
Pin 14	Side Marker Supply - Yellow/Violet

4.24.7 Harnesses and Aftermarket Kits

WARNING: Only Ford release wiring should be used to support added vehicle functionality. If the implementation of wiring other than this is required, Ford guidelines must be followed.

NOTE: The Auxiliary Fuse Panel should be ordered

Refer to: 4.23 Fuses and Relays
Refer to: 4.25 Grounding

In addition to the Auxiliary Fuse Panel, a number of other kits are available to meet customer needs, contact your local Ford Dealer for details.

4.24.8 Additional Vehicle Signals/ Features

WARNING: When interfacing with specific lighting high side driver outputs, additional supplemental signal access, relays and peripherals fitted, must be compatible with a Pulse Width Modulation (PWM) frequency of 200Hz.

For list of lighting circuits that are PWM supplied: Refer to: 4.3 Communications Network BCM Output Information table.

For additional information on lighting loads Refer to: 4.12 Exterior Lighting

4.25 Grounding

4.25.1 Ground Points

CAUTIONS:

- **Only use the ground points indicated. Using alternative points may affect the vehicle integrity.**
- **Make sure that all ground points are tightened to the correct torque.**

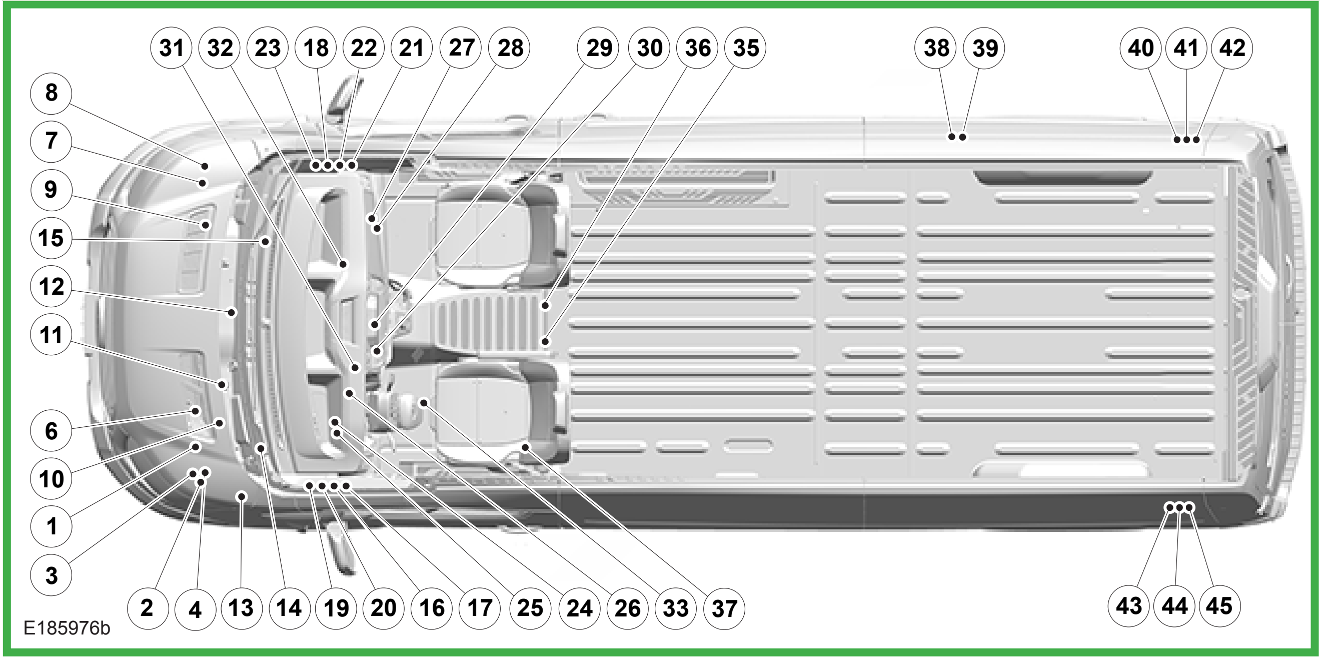
Ground wires should be brought back to the Ford ground points provided, please refer to the following figures.

WARNING: Electrical ground paths (case grounds and/or ground straps and/or low voltage wiring) for High Voltage components on the E-Transit BEV must not be altered or modified in any way.

NOTE: On E-Transit BEV, for Low Voltage (12V) applications, upfitters/convertors need to create a ground point on the body (preferable) or chassis. This may be the use of a welded on stud/nut secured to body sheet metal – requirements for a clean surface to weld to and for corrosion protection afterwards should be followed.

Refer to:
5.1.2 Welding
5.14 Corrosion Prevention

BEV Van, Wagon and Common Ground Points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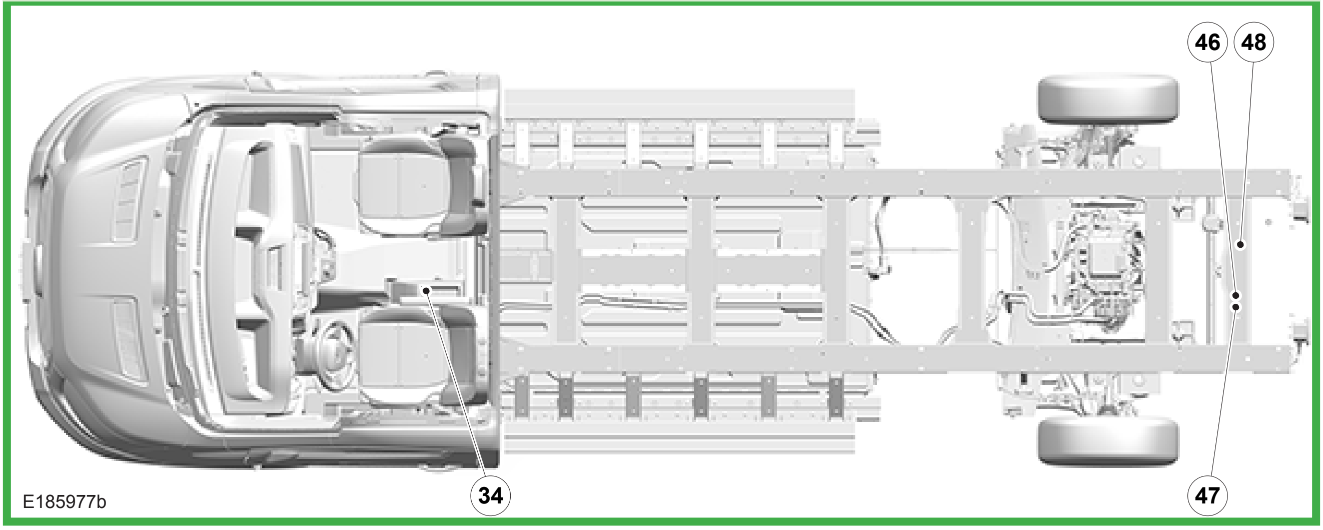
E185976b

BEV Chassis Cab Unique Ground Points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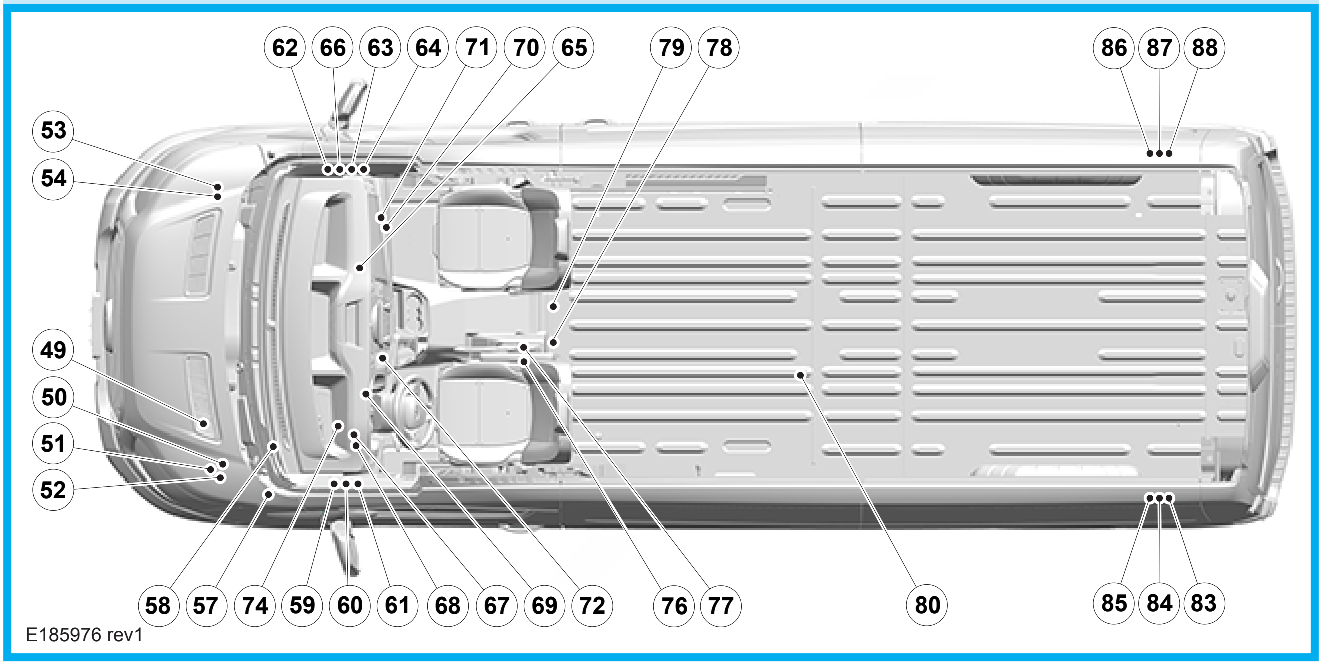
🟩 Abc = BEV Only 🟦 Abc = ICE Only

ICE Van, Wagon and Common Ground Points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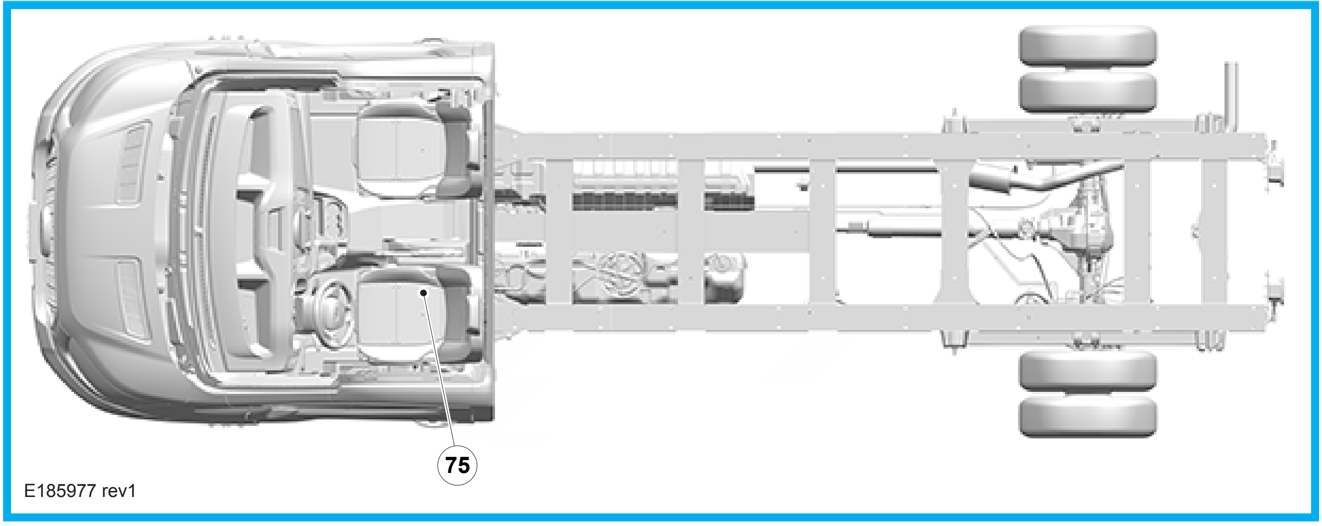
E185976 rev1

ICE Chassis Cab Unique Ground Points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🟩 Abc = BEV Only 🟦 Abc = ICE Only

Ground Point	Location	Type (Use of Ground Point)	Body	Power	Harness
1	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
2	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
3	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
4	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
6	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
7	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
8	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
9	Front End Cradle	HV Megabrace Case	Van/Wagon, CCB/CW	BEV	14301
10	Front End Cradle	HV Megabrace Case	Van/Wagon, CCB/CW	BEV	14301
11	Frame Front	Engine Bay Megabrace	Van/Wagon, CCB/CW	BEV	14K011
12	Frame Front	Engine Bay Megabrace	Van/Wagon, CCB/CW	BEV	14K011
13	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
14	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
15	Frame front	Engine Bay Megabrace	Van/Wagon, CCB/CW	BEV	14K011
16	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
17	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
18	A Pillar	Rear ACC	Van/Wagon, CCB/CW	BEV	14659
19	Bodyside Rear	Rear Lamp Connector	Van/Wagon, CCB/CW	BEV	13A409
20	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
21	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
22	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
23	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
24	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	BEV	14K024
25	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	BEV	14K024
26	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	BEV	14K024
27	Frame Front	Engine Bay Megabrace	Van/Wagon, CCB/CW	BEV	14K011
28	Frame Front	Engine Bay Megabrace	Van/Wagon, CCB/CW	BEV	14K011
29	Frame Front	Engine Bay Megabrace	Van/Wagon, CCB/CW	BEV	14K011
30	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	BEV	14K024
31	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
32	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	BEV	14K024
33	Frame front cross member	Fuel Tank Sender	Van/Wagon	BEV	14406
34	Frame front cross member	Fuel Tank Sender	CCB/CW	BEV	14406
35	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
36	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
37	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	BEV	14401
38	Bracket Body Side	Fuel Tank	Van/Wagon	BEV	14A006
39	Bracket Body Side	Fuel Tank	Van/Wagon	BEV	14A006
40	Bodyside rear	Rear Lamp Connector	Van/Wagon	BEV	13A409
41	Bodyside rear	Rear Lamp Connector	Van/Wagon	BEV	13A409
42	Bodyside rear	Rear Lamp Connector	Van/Wagon	BEV	13A409
43	Bodyside rear	Rear Lamp Connector	Van/Wagon	BEV	13A409
44	Bodyside rear	Rear Lamp Connector	Van/Wagon	BEV	13A409
45	Bodyside rear	Rear Lamp Connector	Van/Wagon	BEV	13A409
46	Rear Floor Crossmember	Axle Sensor Rear	CCB/CW	BEV	14A107
47	Bodyside rear	Rear Lamp Connector	CCB/CW	BEV	13A409
48	Rear Floor Crossmember	Axle Sensor Rear	CCB/CW	BEV	14A107

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Ground Point	Location	Type (Use of Ground Point)	Body	Power	Harness
49	Engine Bay Side Inner	Exhaust Gas Gauge	Van/Wagon, CCB/CW	ICE	9K499
50	Engine Bay Side Inner	Exhaust Gas Gauge	Van/Wagon, CCB/CW	ICE	9K499
51	Engine Bay Side Inner	Exhaust Gas Gauge	Van/Wagon, CCB/CW	ICE	9K499
52	Engine Bay Side Inner	Exhaust Gas Gauge	Van/Wagon, CCB/CW	ICE	9K499
53	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
54	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
57	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
58	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
59	Bodyside Rear	Rear Lamp Connector	Van/Wagon, CCB/CW	ICE	13A409
60	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
61	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
62	A Pillar	Rear ACC	Van/Wagon	ICE	14659
63	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
64	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
65	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	ICE	14K024
66	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
67	CrossCarBeam	Instrument Panel	Van/Wagon, CCB/CW	ICE	14K024
68	CrossCarBeam	Instrument Panel	Van/Wagon, CCB/CW	ICE	14K024
69	CrossCarBeam	Instrument Panel	Van/Wagon, CCB/CW	ICE	14K024
70	Frame Front Crossmember	Fuel Tank Sender	Van/Wagon, CCB/CW	ICE	14406
71	Frame Front Crossmember	Fuel Tank Sender	Van/Wagon, CCB/CW	ICE	14406
72	Cross Car Beam	Instrument Panel	Van/Wagon, CCB/CW	ICE	14K024
74	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
75	Frame Front Crossmember	Fuel Tank Sender	CCB/CW	ICE	14406
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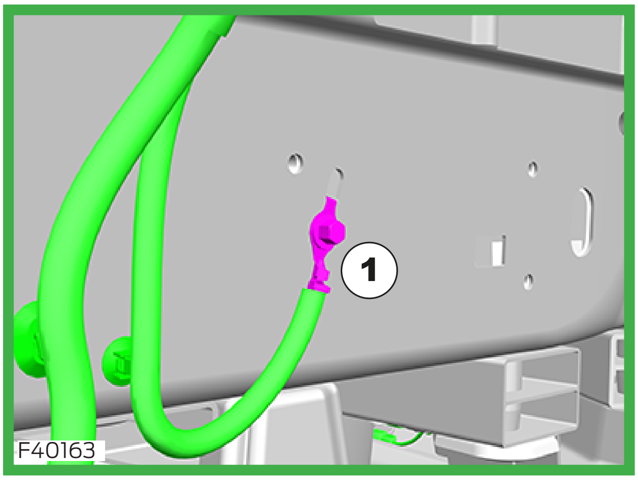
77	Frame Front Crossmember	Fuel Tank Sender	Van/Wagon, CCB/CW	ICE	14406
78	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
79	Front Floor/Turret/Fender	Wire Assy Main	Van/Wagon, CCB/CW	ICE	14401
80	Frame Front Crossmember	Fuel Tank Sender	Van/Wagon, CCB/CW	ICE	14406
83	Bodyside rear	Rear Lamp Connector	Van/Wagon	ICE	13A409
84	Bodyside rear	Rear Lamp Connector	Van/Wagon	ICE	13A409
85	Bodyside rear	Rear Lamp Connector	Van/Wagon	ICE	13A409
86	Bodyside rear	Rear Lamp Connector	Van/Wagon	ICE	13A409
87	Bodyside rear	Rear Lamp Connector	Van/Wagon	ICE	13A409
88	Bodyside rear	Rear Lamp Connector	Van/Wagon	ICE	13A409

Ford M6 x 1.0, 20mm thread rolling screw - torque 8.85 ft lb (12Nm) ± 1.3 ft lb (± 1.8Nm)

Abbreviations used in table: LHS - Left Hand Side, RHS - Right Hand Side, Misc - Miscellaneous, CCB - Chassis Cab, CW - Cutaway, BEV - Battery Electric Vehicle, ICE - Internal Combustion Engine

🟩 Abc = BEV Only 🟦 Abc = ICE Only



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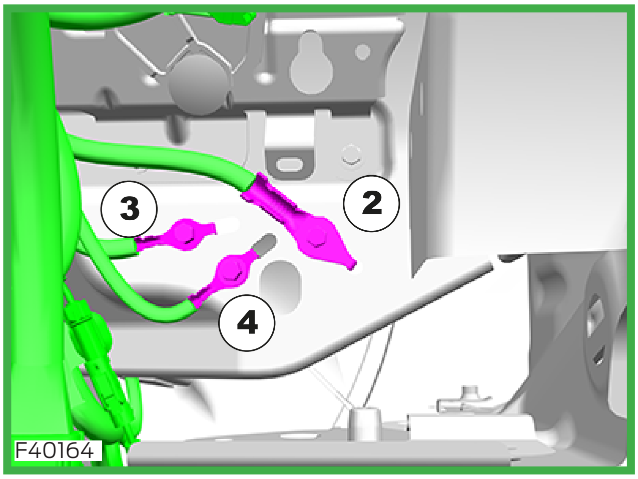

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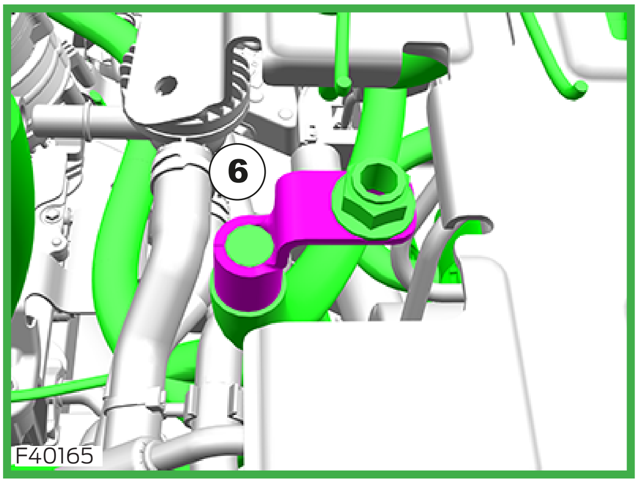

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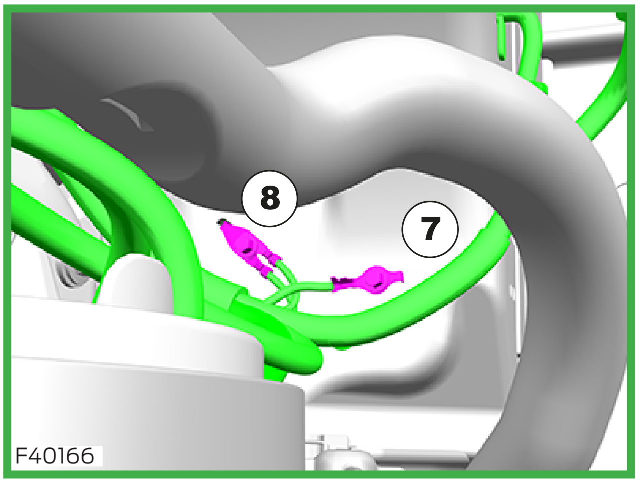

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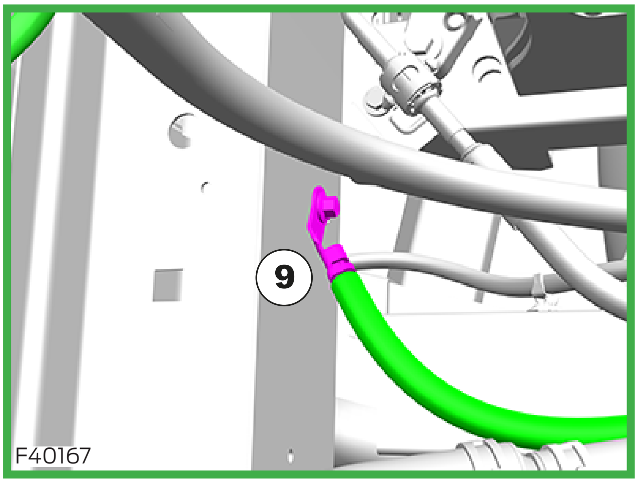

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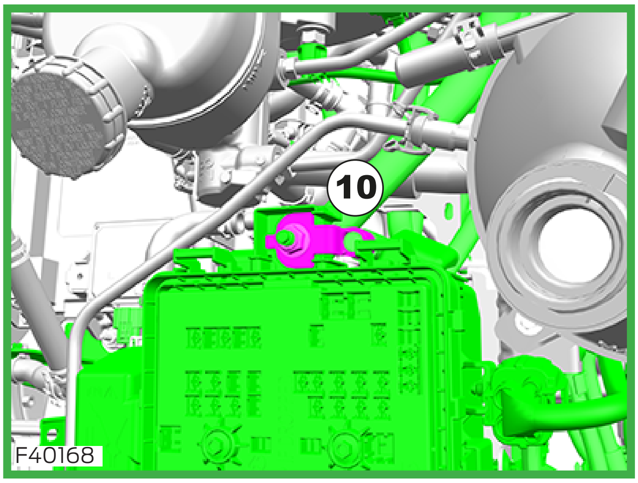

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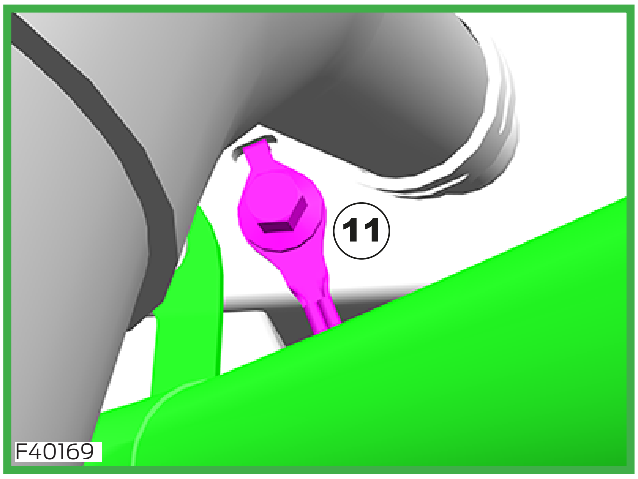

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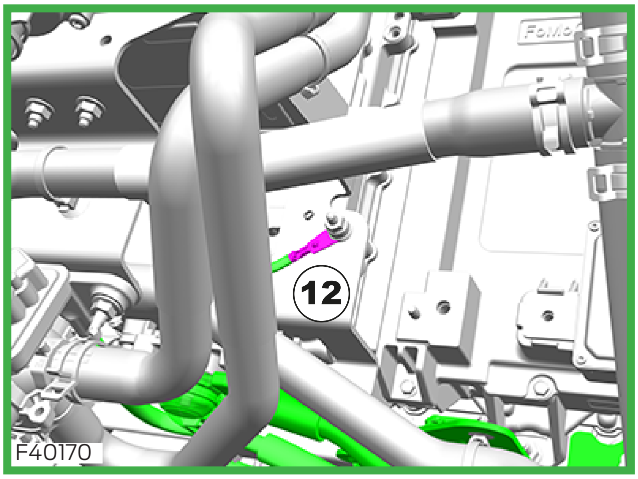

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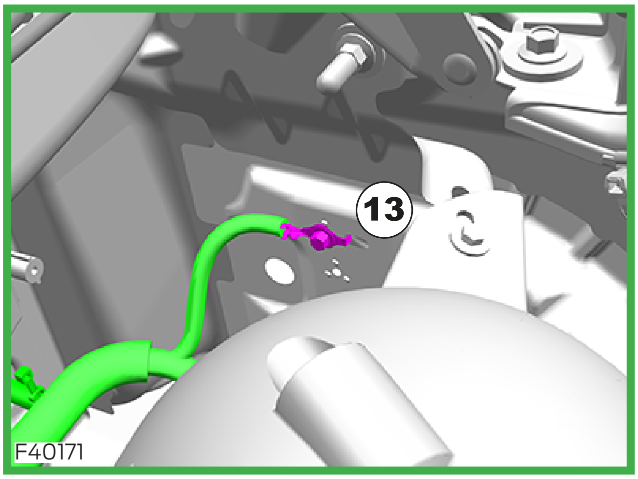

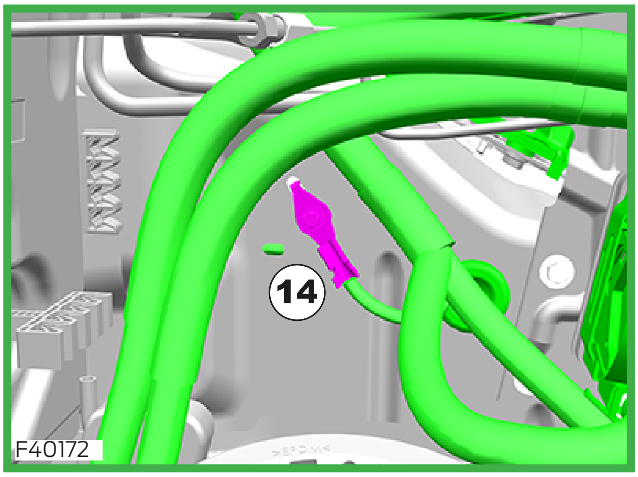

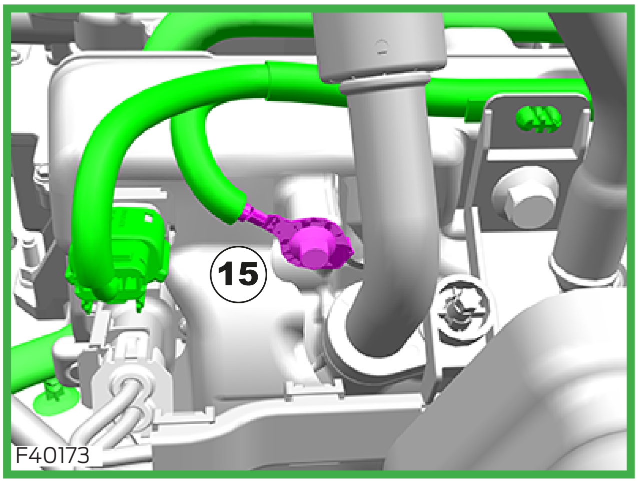

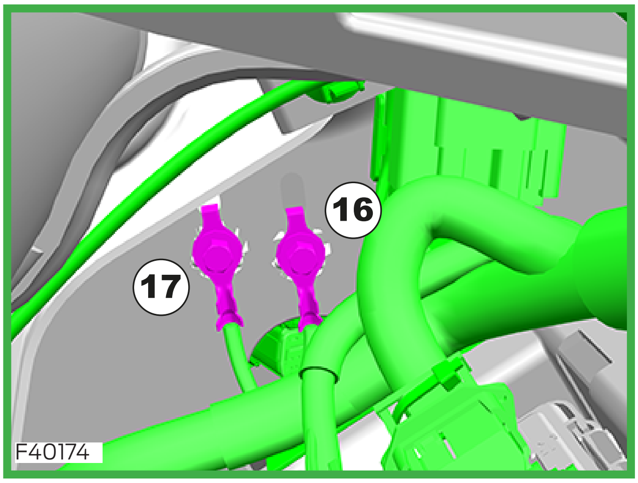
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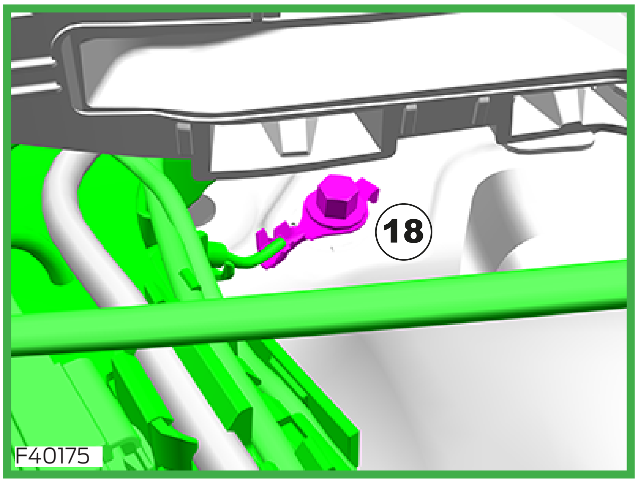

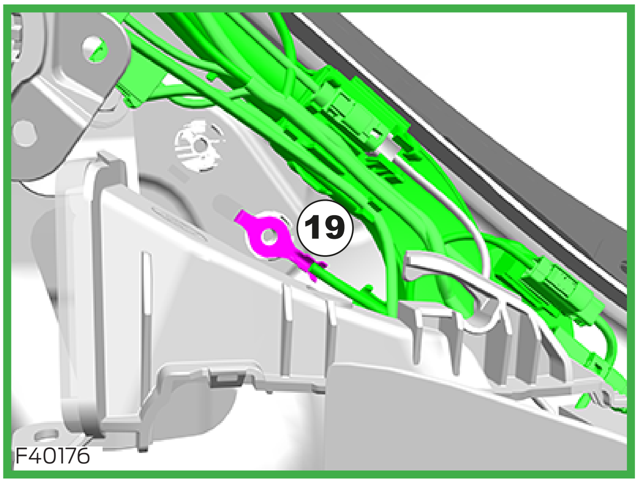

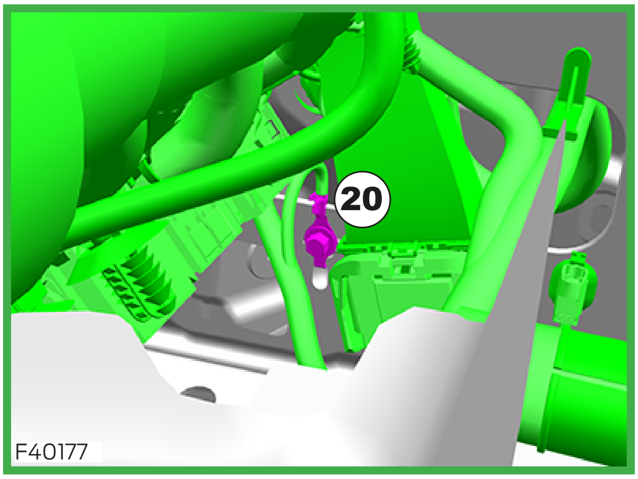

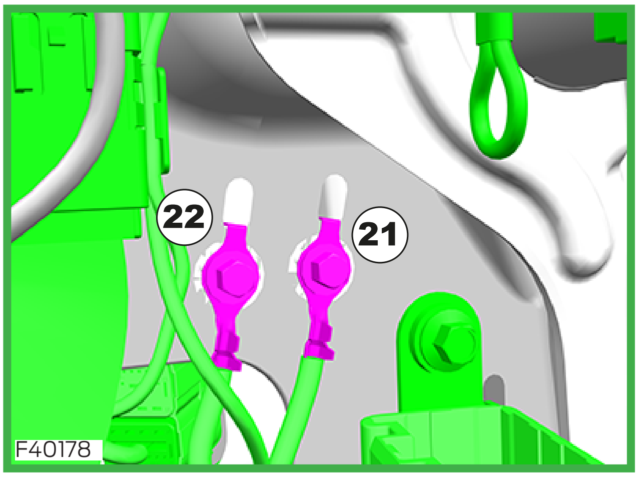
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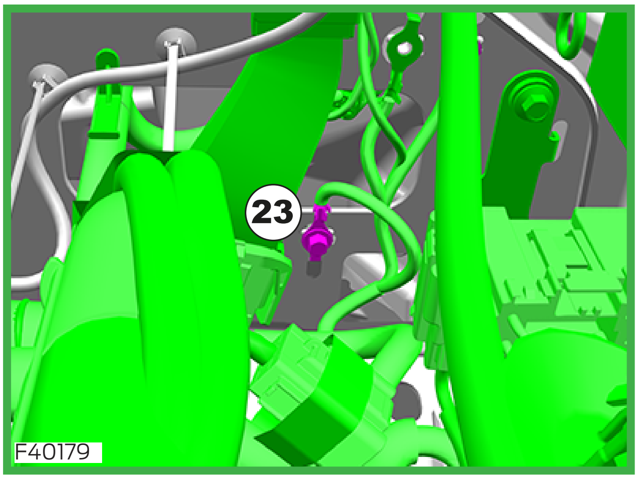
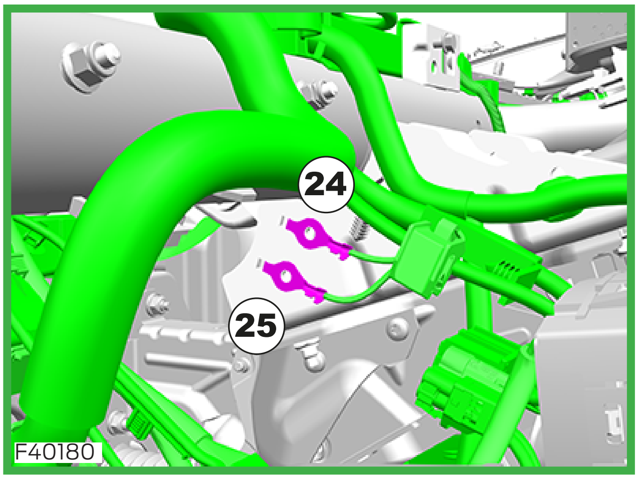
🟩 Abc = BEV Only 🟦 Abc = ICE Only

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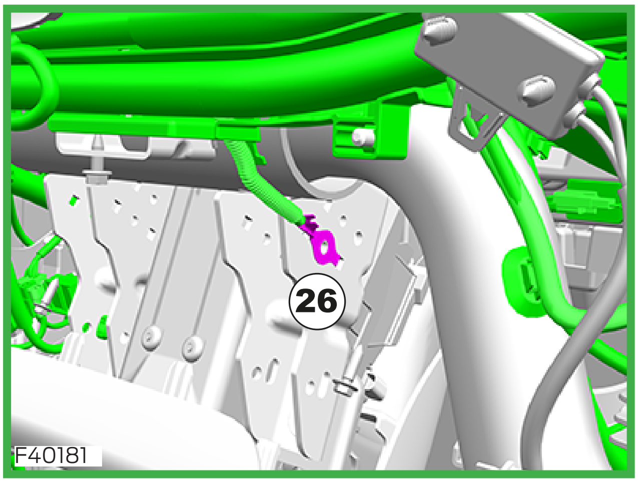

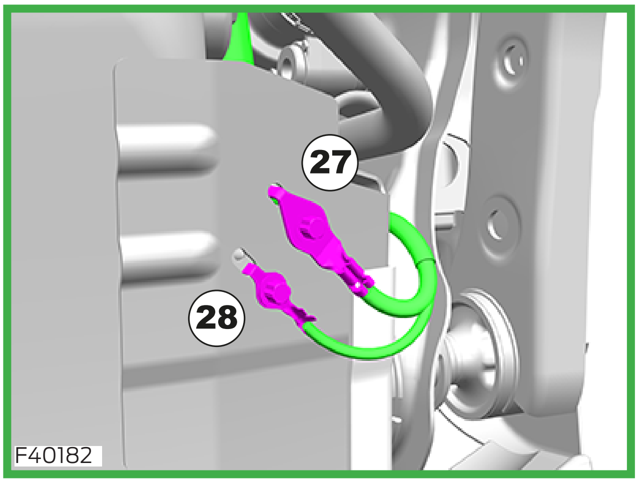
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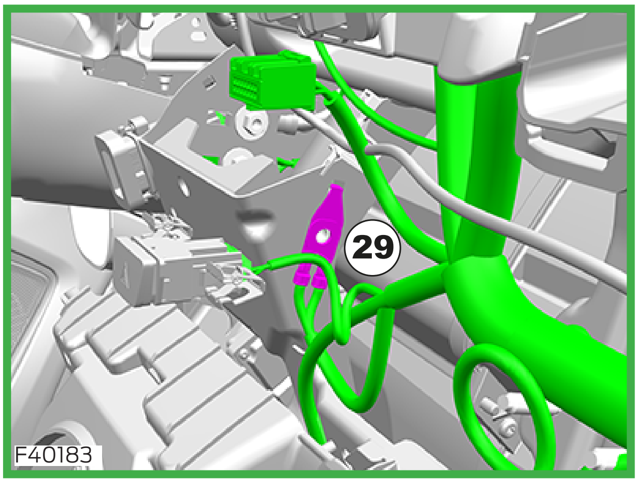
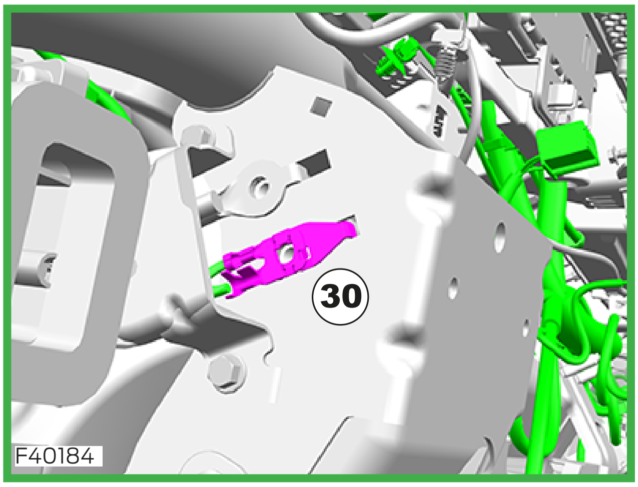
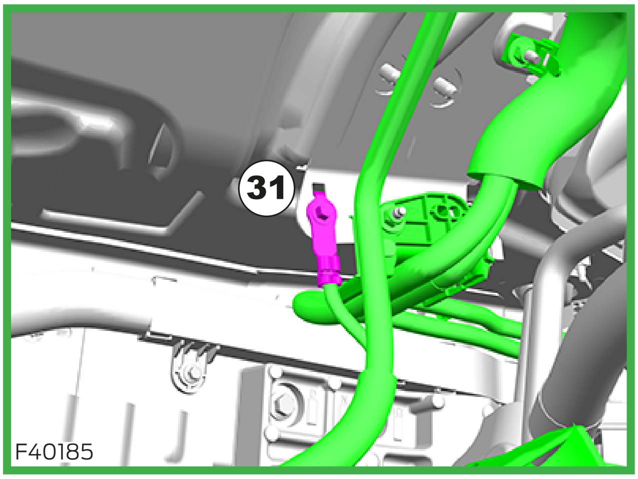
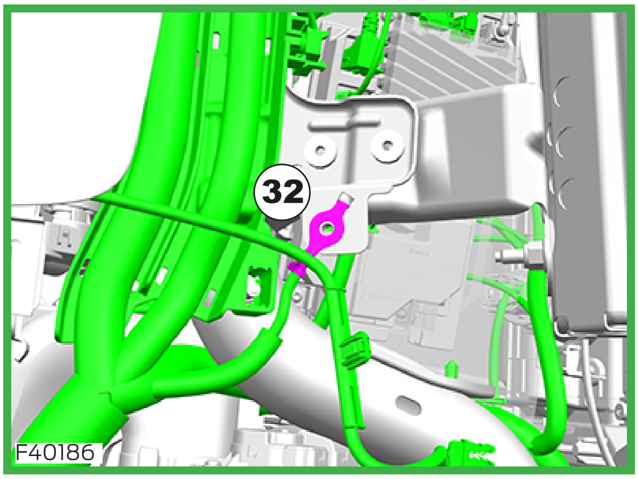
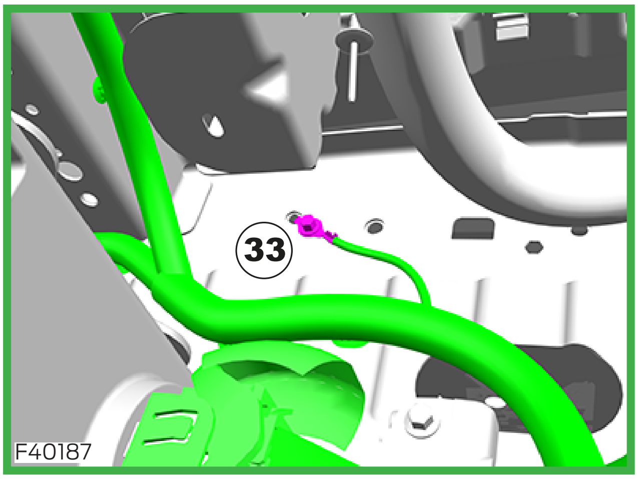


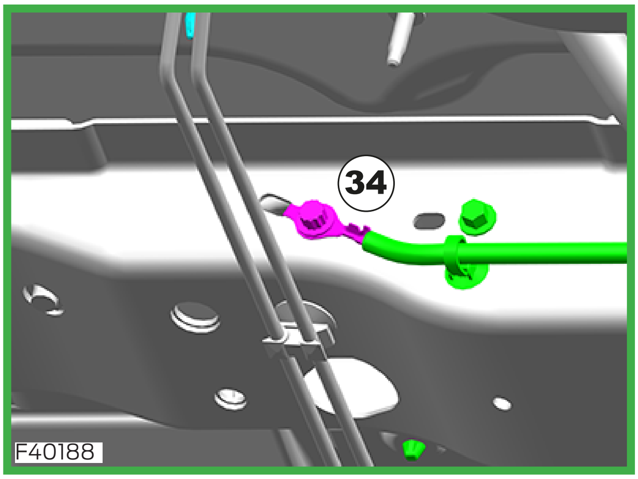


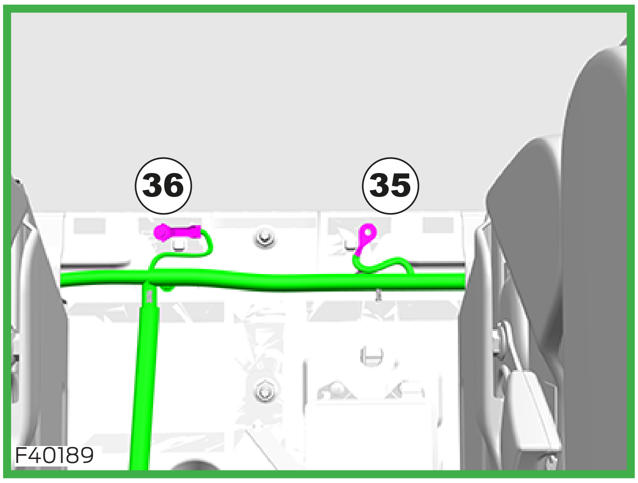




🟩 Abc = BEV Only 🟦 Abc = ICE Only



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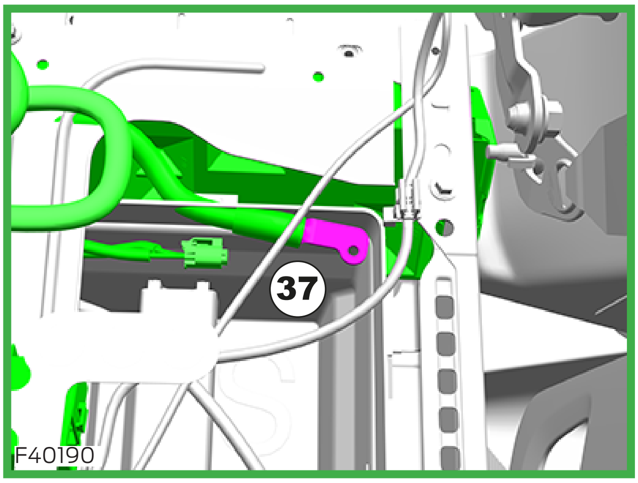

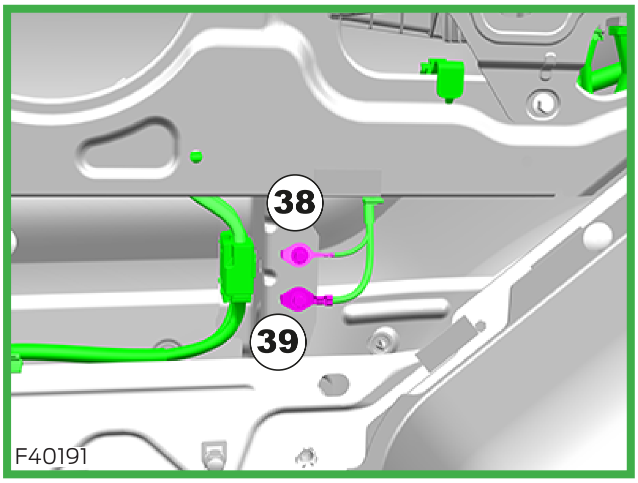
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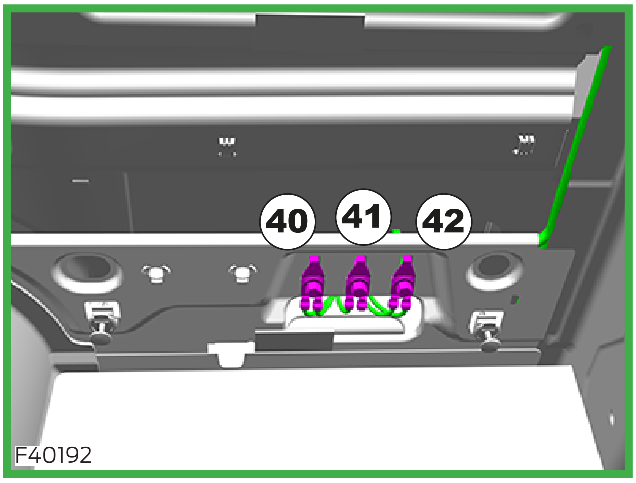
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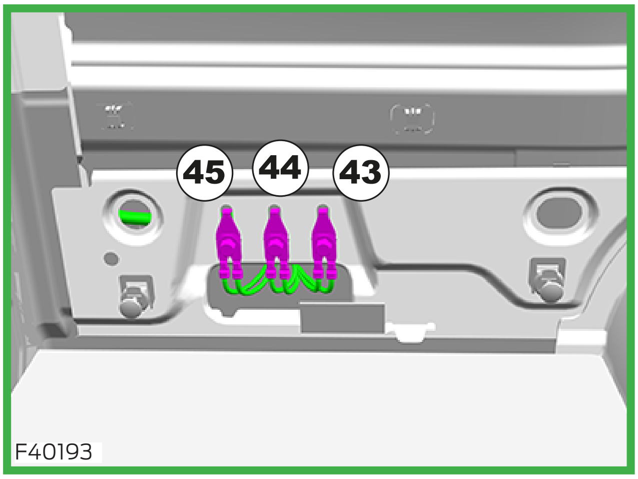
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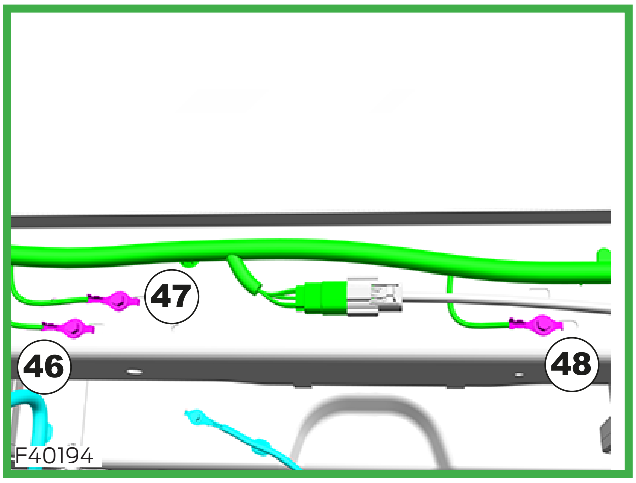
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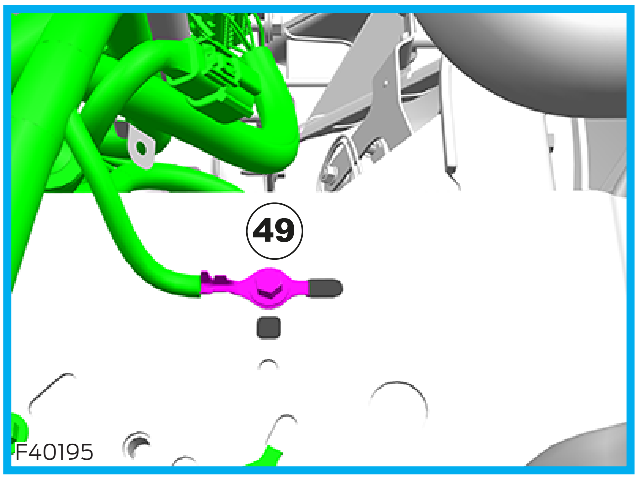
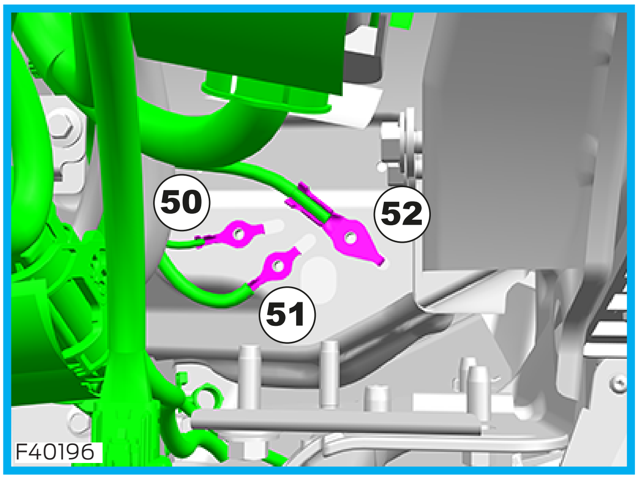
🟩 Abc = BEV Only 🟦 Abc = ICE Only

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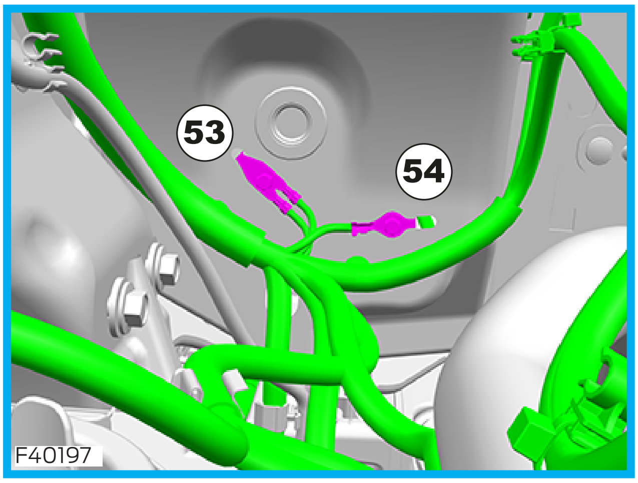
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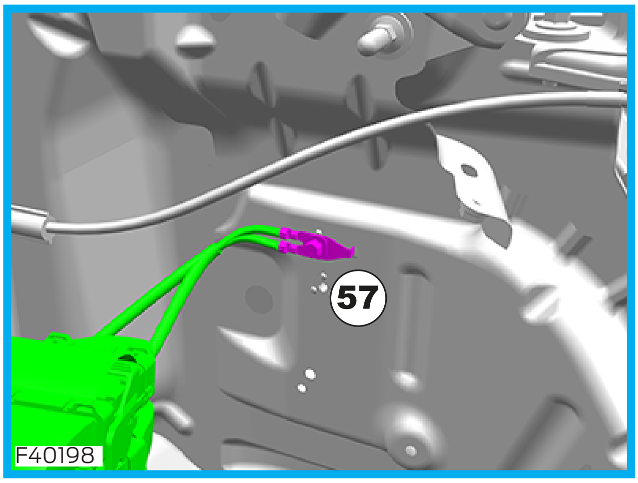

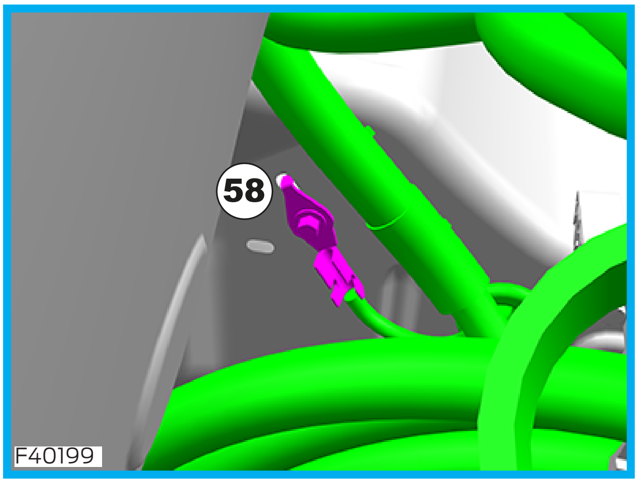

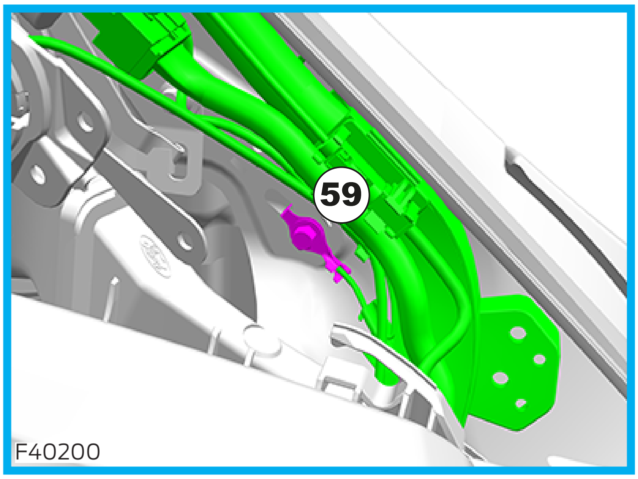

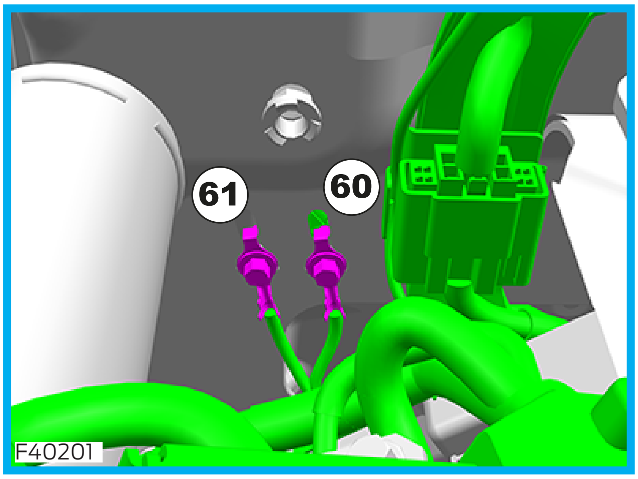
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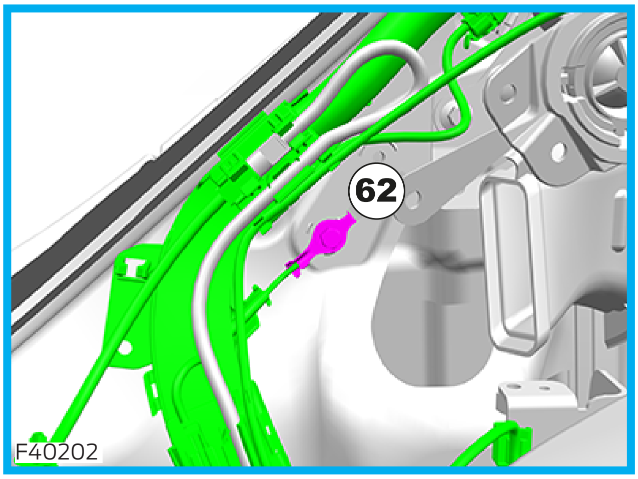
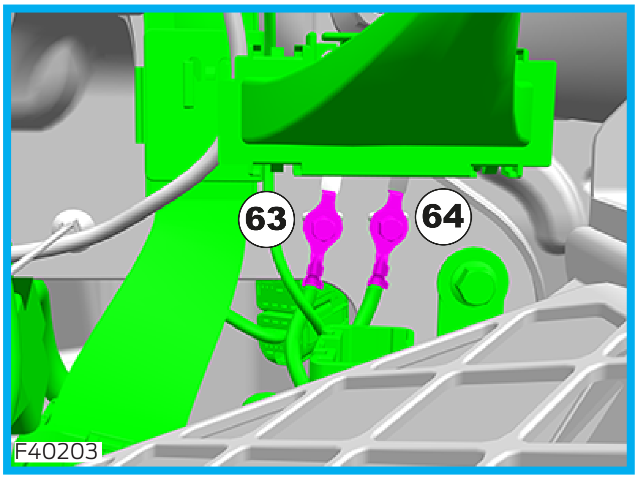


🟩 Abc = BEV Only 🟦 Abc = ICE Only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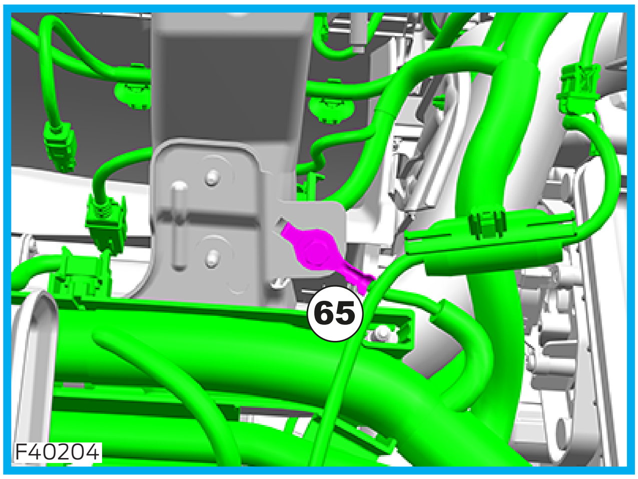

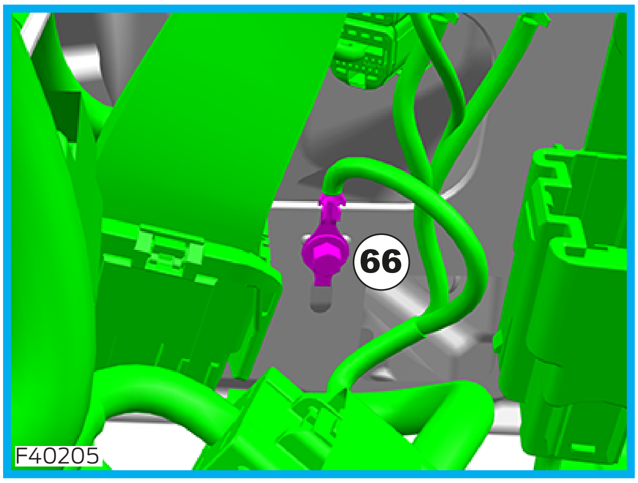

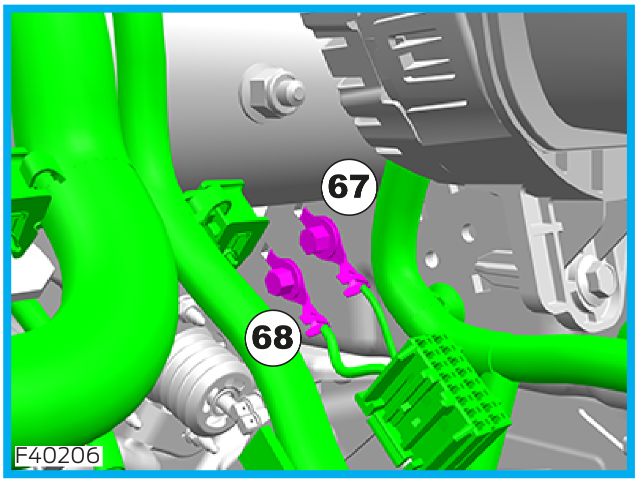
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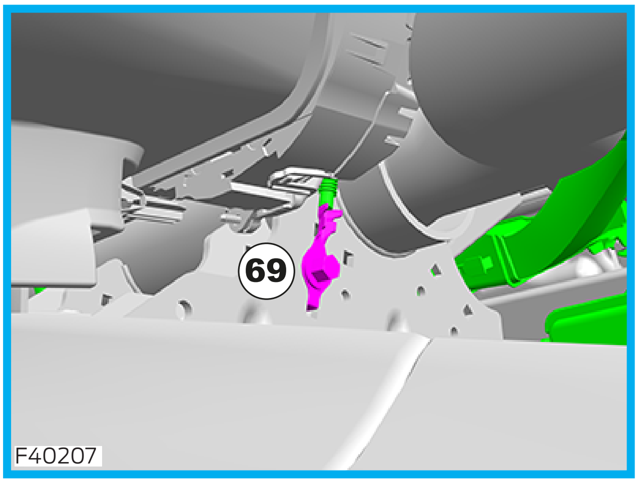

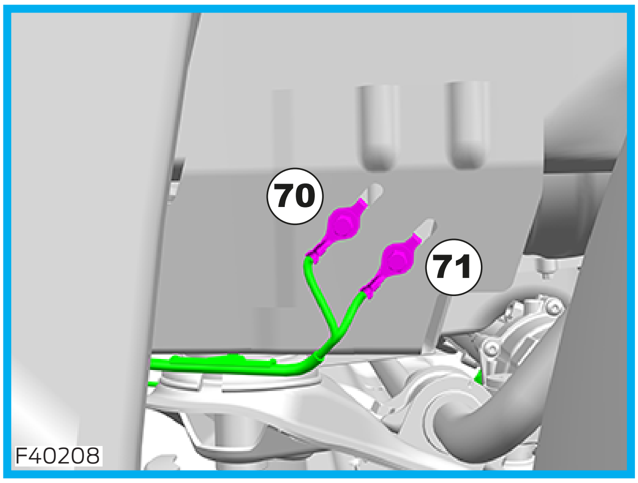
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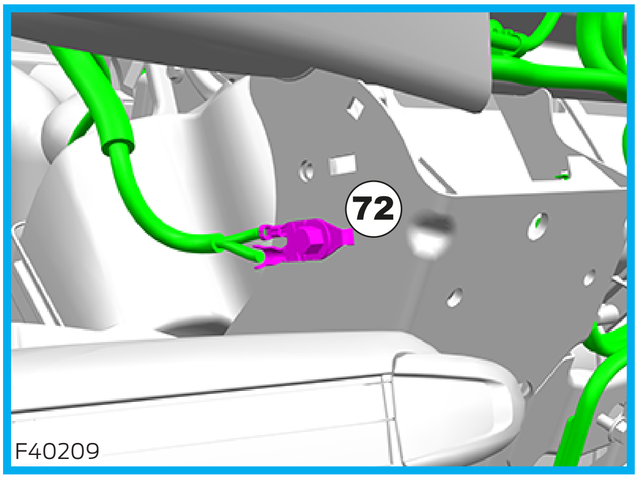
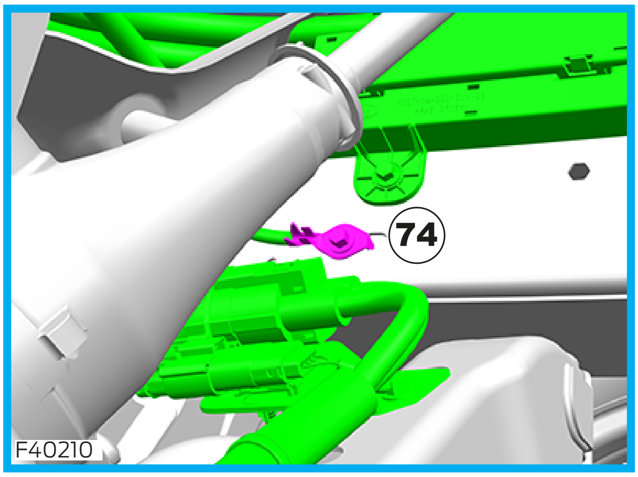
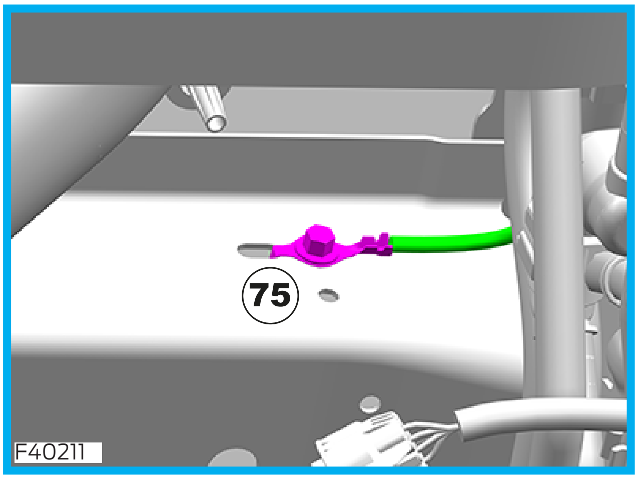
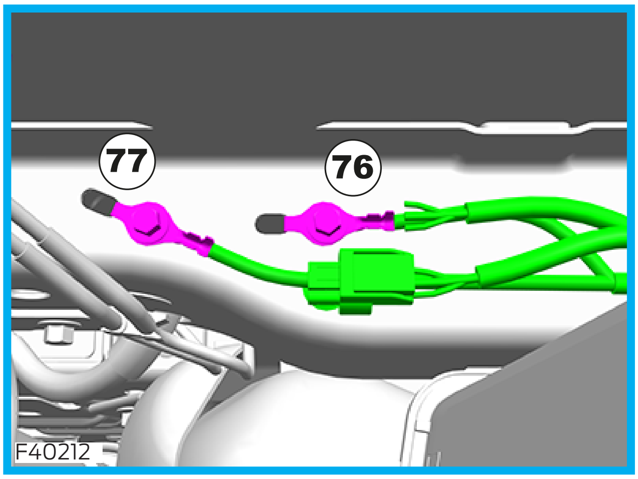




🟩 Abc = BEV Only 🟦 Abc = ICE Only

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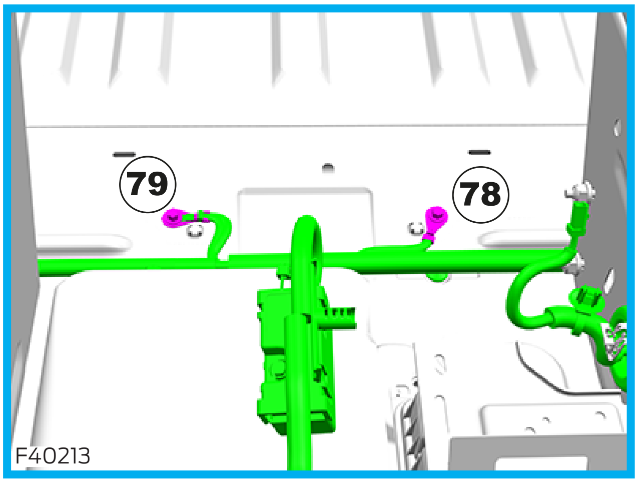
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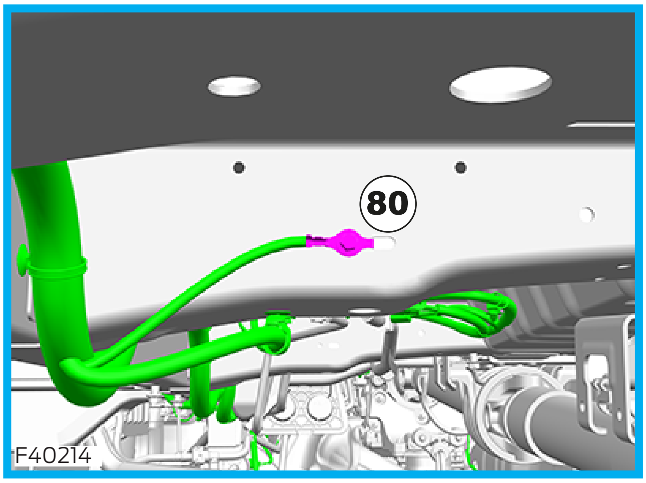

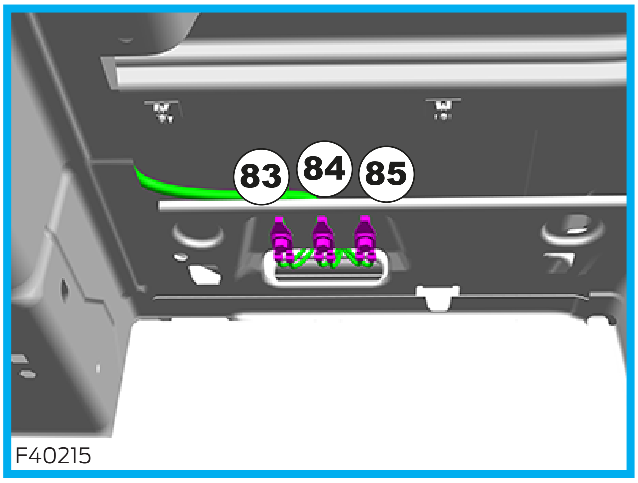
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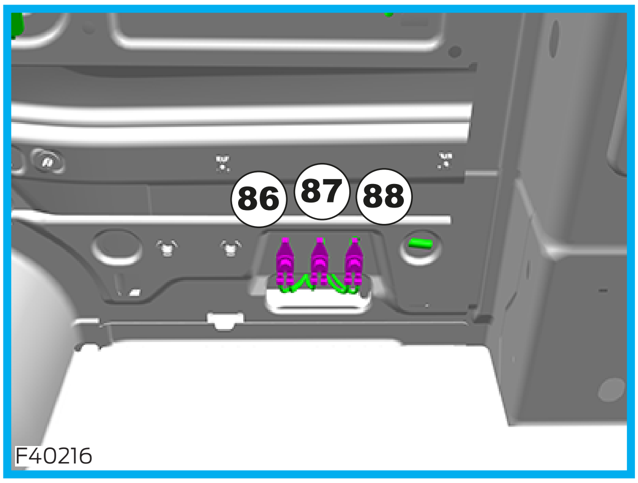
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5.1 Body

5.1.1 Body Structures - General Info

WARNINGS:

Before drilling see figures E184299 and E185270 for Boron Steel parts, in this section of the manual.

Before drilling the floor around the fuel tank, check the [Precautionary Drill Zones](#) in this section.

Extreme heat, such as paint drying ovens, will cause the damage of the High Voltage battery. The High Voltage battery must be removed before using paint drying ovens longer than 45 minutes or with temperatures above 140ºF (60ºC). Failure to follow this instruction may result in damaging the High Voltage battery, which could cause serious personal injury or death in a fire or explosion. Please refer to the Ford E-Transit workshop manual.

The following components, as installed by Ford Motor Company, should not be removed, relocated, altered, or modified in any way:

- **High voltage battery, battery connectors, battery cradle (carrying structure), outriggers, energy absorption members, brackets, and attachment hardware.**
- **Front-end structure, including aluminum extrusion assembly ("Megabrace"), attachment brackets, and attachment hardware.**

All fixings through the floor, sides or roof must be sealed.

The Ford side protection must not be removed as part of any conversion.

CAUTION: Uneven load distribution could result in unacceptable handling and braking characteristics.

When carrying out vehicle conversions the following points should be considered:

- Make sure that the vehicle structural integrity is maintained
- Do not drill into closed frame body members
- Make sure that the design for the body alterations or additional structure disperses the load evenly
- Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection legislation

Ensure proper sealing against ingress of water, salt, dust, after cutting or drilling the body. Use Ford approved sealing and finishing materials, and underbody corrosion protection.

Refer to: 5.14 Corrosion Prevention

- Make sure that fixings in the 'B' pillar area do not encroach on the seat belts or seat belt reels

For unique floor fixings, see (Frame Drilling and Tube Reinforcing) Refer to: 5.14 Frame and Body Mounting

For Load Compartment Tie Downs (Load Lashing Points) Refer to: 5.4 Loadspace

For additional Precautionary Drill Zones
Refer to: 4.2 Wiring Installation and Routing Guides
Refer to: 5.6 Body Closures

Specific to the E-Transit BEV:

WARNINGS:

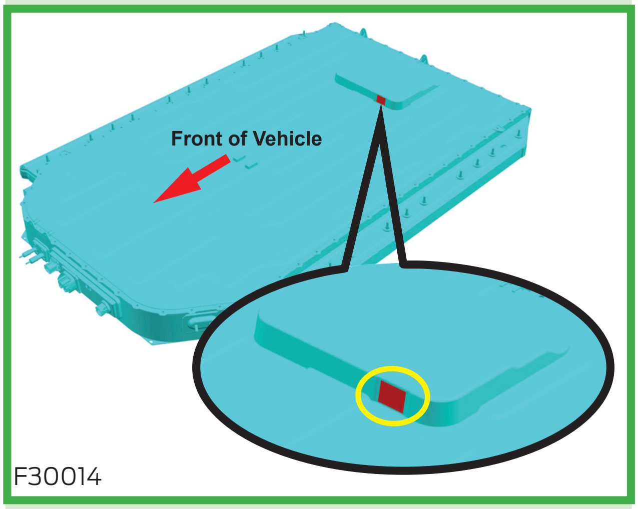
The E-Transit BEV HV Battery is equipped with an exhaust vent. No additional components nor obstructions (beyond any installed by Ford) shall be located in the same environment as the battery (e.g., underbody) and within 150 mm of these features. Additionally, no components which may contain combustible liquids or gases at any time shall be added by the upfitter within 300 mm of these features.

There shall be no modifications or installed components which confine the air space near the outside of the HV Battery or obstruct the free flow of air about the battery (beyond any installed by Ford).

Any cut outs or openings created between the occupant space and the vehicle underbody shall be sealed such that air is not free to pass from under the vehicle into the occupant space.

If any primary ingress/egress paths for occupant spaces are located above or rearward of the rear axle(s), a metallic shielding shall be added to obstruct any airflow from the battery towards those ingress/egress paths, and redirect that air flow towards a side/rear area that is not a primary ingress/egress path.

HV Battery Vent - Standard Range Battery



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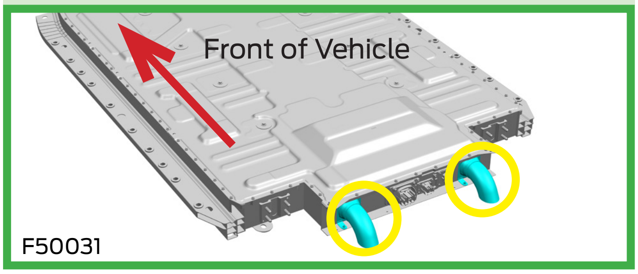
HV Battery Vent - Enhanced Range Battery



5.1.2 Welding/Plasma Cutting

WARNING: Before welding see figures E184299 and E185270 for Boron Steel parts, in this section of the manual.

Before welding work is performed on a vehicle body, all safety measures for the protection of people, modules and electrical components must be observed.

Electronic Components

NOTE: After disconnecting the power supply and before performing further work, a wait time of up to 15 minutes must be maintained, depending on the vehicle. Work on airbag systems may only be performed by a Ford dealer.

Increased use of comfort and safety electronics in modern motor vehicles also requires the greatest attention to be paid during body work. Over voltages produced during welding and in alignment work during body shell rectification, may cause electronic systems to be damaged. In particular, the safety instructions for performing welding work on vehicles with airbag systems must be adhered to.

Pay attention to the following points:

- Disconnect the battery negative clamp and cover the battery terminal
- Disconnect the electrical connector at the airbag control module
- Disconnect: Powertrain Control Module, Cluster, ABS Module, Fuel Tank, Body Control Module, Diesel and SCR Module
- If welding is to be performed directly near a control module, it must be removed beforehand
- Never connect the negative cable of the welder near an airbag or a control module
- Connect the negative cable of the welder close to the location of the weld

Before Welding

Interior surfaces of new bodywork components which will no longer be accessible after installation, must be painted beforehand. The welding flanges are treated with a special welding primer. The joint areas are not always accessible from inside later, therefore, prepare these areas so that no soot is produced by burning paint during welding.

NOTE: In order to ensure that the corrosion protection produced in production is not destroyed, the working area must be kept as small as possible.

NOTE: Do not touch cleaned bare metal with bare hands. The dampness of your hands will corrode the metal.

Procedure:

- Remove the primer or paint/zinc layer in the welding area using a tress wire brush to prevent the formation of soot from the paint
- Thoroughly clean the welding area with a metal cleaning agent and rub dry
- Coat the welding flange with welding primer on all sides and allow to dry

NOTE: The welding primer must only be applied thinly to the spot welding area, to minimize spattering when welding.

The following points must be noted when welding:

- Zinc starts to melt at about 420°C
- Zinc vaporises at a temperature of about 900°C
- The amount of heating determines the damage to the zinc coating, and therefore to the corrosion protection
- Resistance spot welding is particularly suitable for welding zinc coated panels, because no widespread warming occurs
- With electrolytically zinc-plated panels there is no need for any special preparation because the zinc coating does not need to be removed

After Welding

During work, body panels are often heated at very high temperatures, which results in the destruction of the corrosion protection. Working of the affected areas is therefore vital:

- Grind the welded seams flat and clean thoroughly with silicone remover. Dry with a lint-free cloth
- If the join area is accessible from the inside, the transition area to the paint must be abraded for all types of join, so that good adhesion of the primer is achieved later
- If the join area is not accessible from the inside and the cleaning and sanding work cannot be done, ensure that there is as little contamination as possible in the area of the repair. This allows the cavity wax applied later to penetrate the join area without hindrance

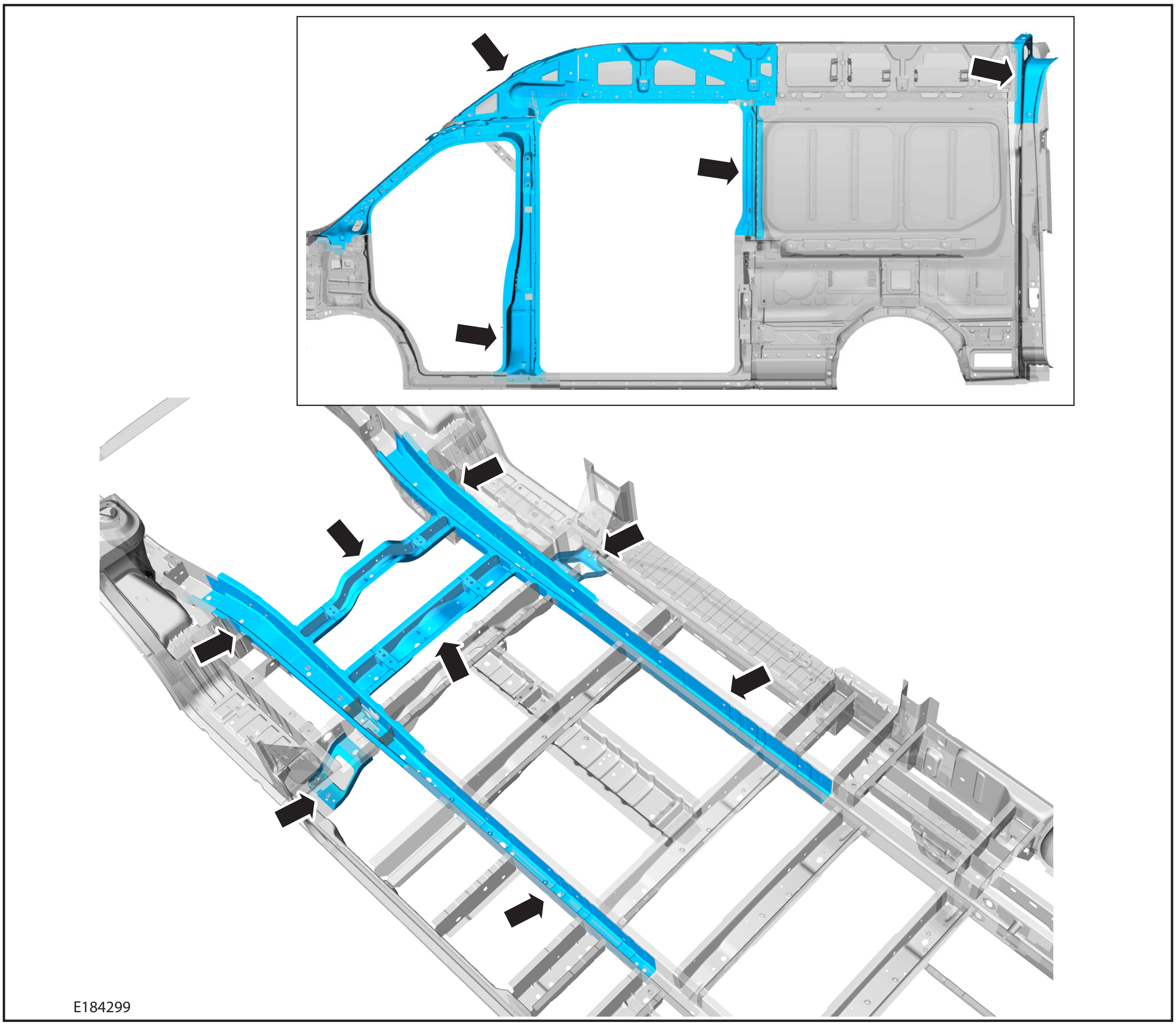
NOTE: Only apply a small amount of panel cleaner to the cleaning cloth when cleaning the area. Make sure that no cleaner reaches the connecting flange, so that the welding primer is not washed away.

Priming after welding

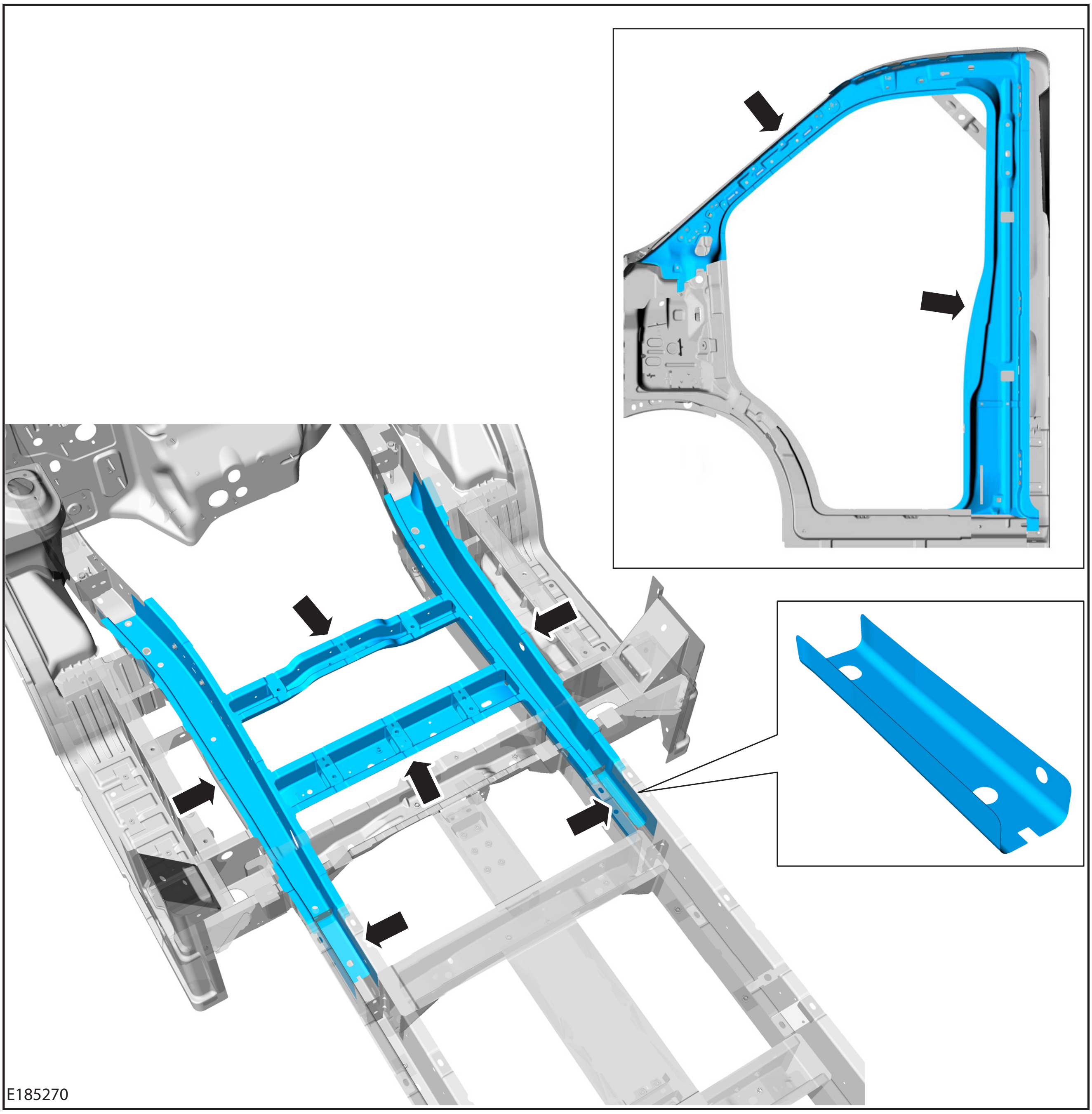
Primer should be applied to the welded flanges after cleaning. A check must also be made that the production corrosion protection is present in the area of the flanges. Any damage must also be re-primed.

5.1.3 Boron Steel Parts

Boron Steel Parts, Van/Wagon - Precautionary Drill or Weld Zones



Boron Steel Parts, Chassis Cab/Cutaway - Precautionary Drill or Weld Zones



5.1.4 Floor Precautionary Drill Zones - Gasoline

WARNINGS:

⚠ **Use care when drilling around fuel tank, lines, use drill shields where applicable, use drill depth gauges, don't point fasteners down/towards fuel components, use acorn style rounded cap nuts where possible.**

⚠ **All fixings through the floor, sides or roof must be sealed.**

❗ **CAUTION: Care should be taken when drilling the floor of the passenger compartment and rear cargo area. The fuel tank, brake lines and electic cables are present below the floor.**

It is recommended that Transit Van CAD is obtained to understand vehicle component placement/location of Fuel tank, fuel filler, wire harness routing, and hydraulic brake line routing. CAD can be obtained from **Ford Body Builder Advisory Service** by submitting a helpdesk ticket bbasqa@ford.com

When adding holes/fasteners to the floor of the vehicle, consideration must be given to all components below the floor.

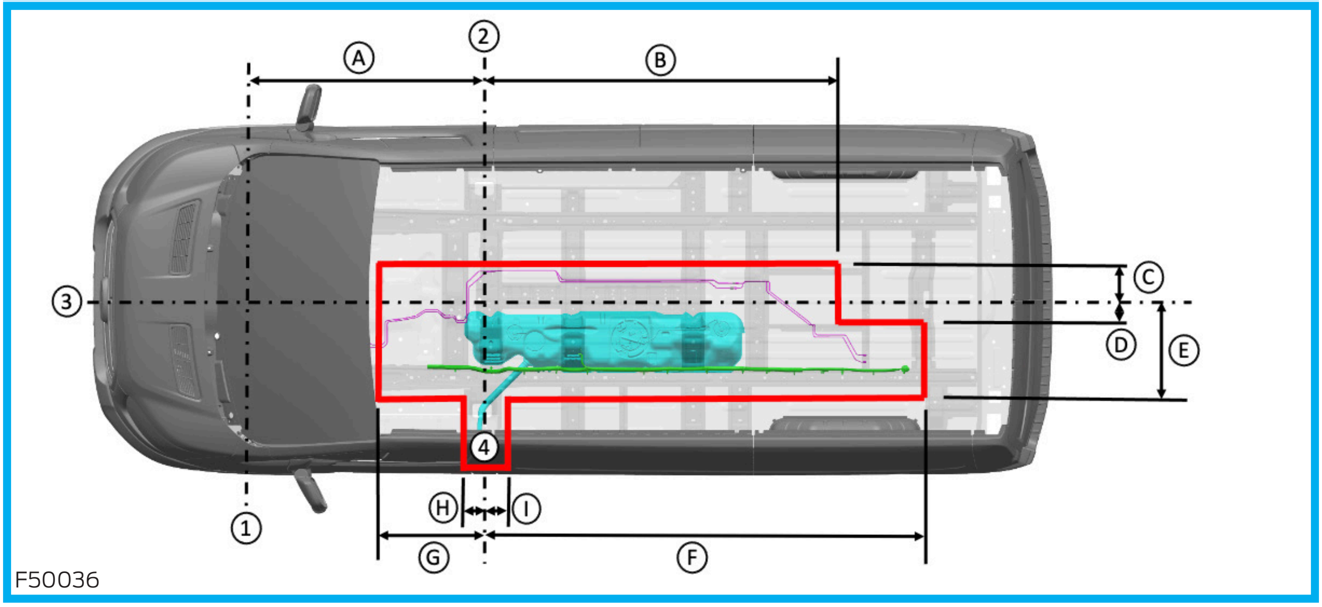
It is strongly recommended that drill-depth stops be used. Drill stop depth shall not exceed 1.0" (25mm) maximum depth.

Fuel tanks come in Standard and Extended range. Both are shown for exemplary purposes.

NOTE: Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection requirements.

Refer to:
5.1.1 Body Structures - General Info
5.14 Corrosion Prevention

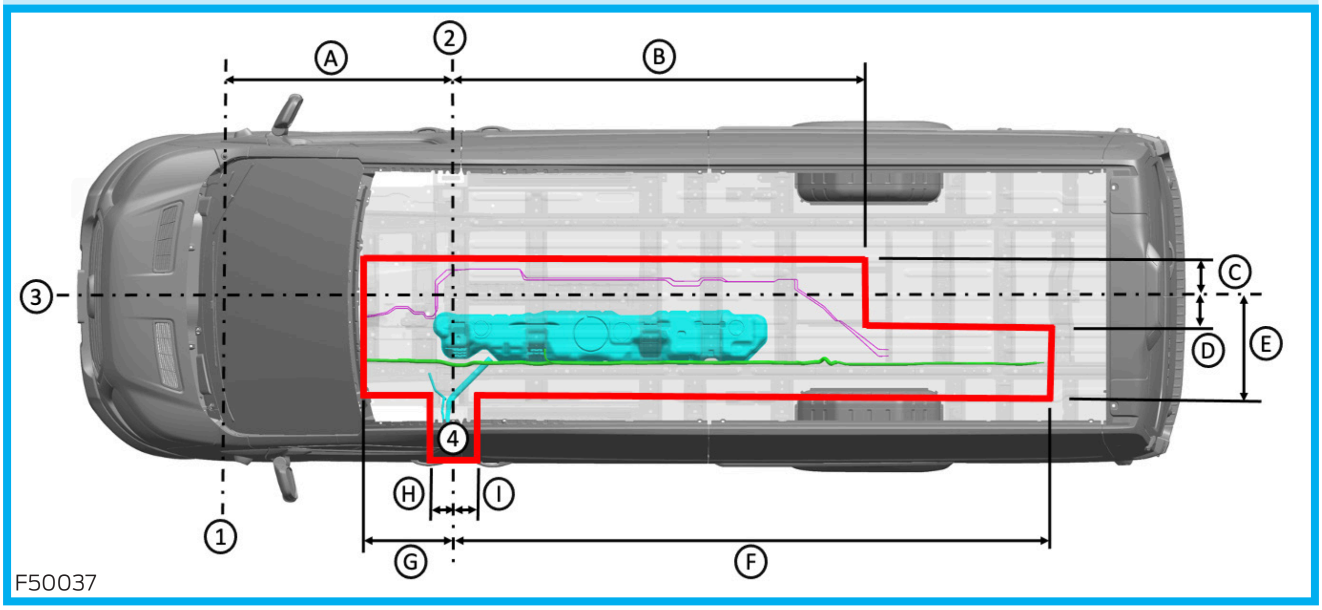
Floor Precautionary Drill Zones - MWB Gasoline Van (25.1 Gallon/95L tank shown)



Floor Precautionary Drill Zones			
1	Center Line Front Wheel Axle	D	6"(150mm)
2	Center Line 'B' Pillar	E	22"(555mm)
3	Center Line of Vehicle	F	102"(2595mm)
4	Fuel Filler - Driver's Side 'B' Pillar	G	25"(625mm)
A	49"(1235mm)	H	3"(75mm)
B	67"(1705mm)	I	3"(75mm)
C	9"(220mm)		

Color Key			
🟦	Fuel Tank	🟪	Brake Lines
🟩	Electrical Harness		

Floor Precautionary Drill Zones - LWB Gasoline Van (30.4 Gallon/115L Tank Shown)



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Floor Precautionary Drill Zones			
1	Center Line Front Wheel Axle	D	6"(150mm)
2	Center Line 'B' Pillar	E	22"(555mm)
3	Center Line of Vehicle	F	144"(3650mm)
4	Fuel Filler - Driver's Side 'B' Pillar	G	25"(625mm)
A	49"(1235mm)	H	3"(75mm)
B	95"(2400mm)	I	3"(75mm)
C	9"(220mm)		

Color Key			
🟦	Fuel Tank	🟪	Brake Lines
🟩	Electrical Harness		

5.1.5 No Drill/No Weld Zones - BEV

WARNINGS:

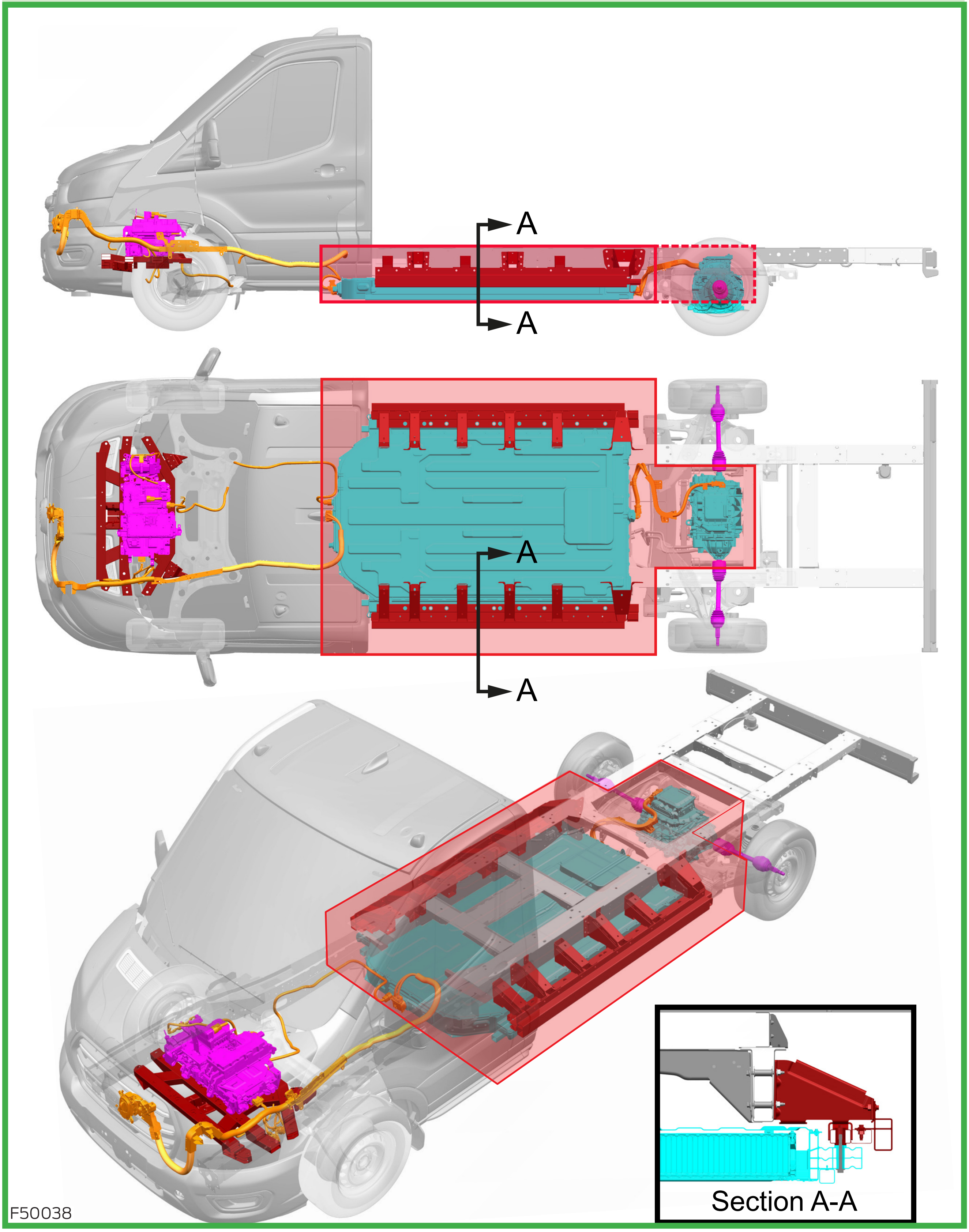
⚠ **Do not undertake drilling welding, or any other operation, in the red marked zone in order to prevent damage to the components placed underneath the floor, in particular battery and high voltage system components. *Refer to: separate guidance in [Section 5.1.6 BEV Van Floor Drilling](#).**

⚠ **Do not drill the Side Impact Bars or Side Energy Absorption Members**

⚠ **Do not weld to the High Voltage Battery, casing or cradle**

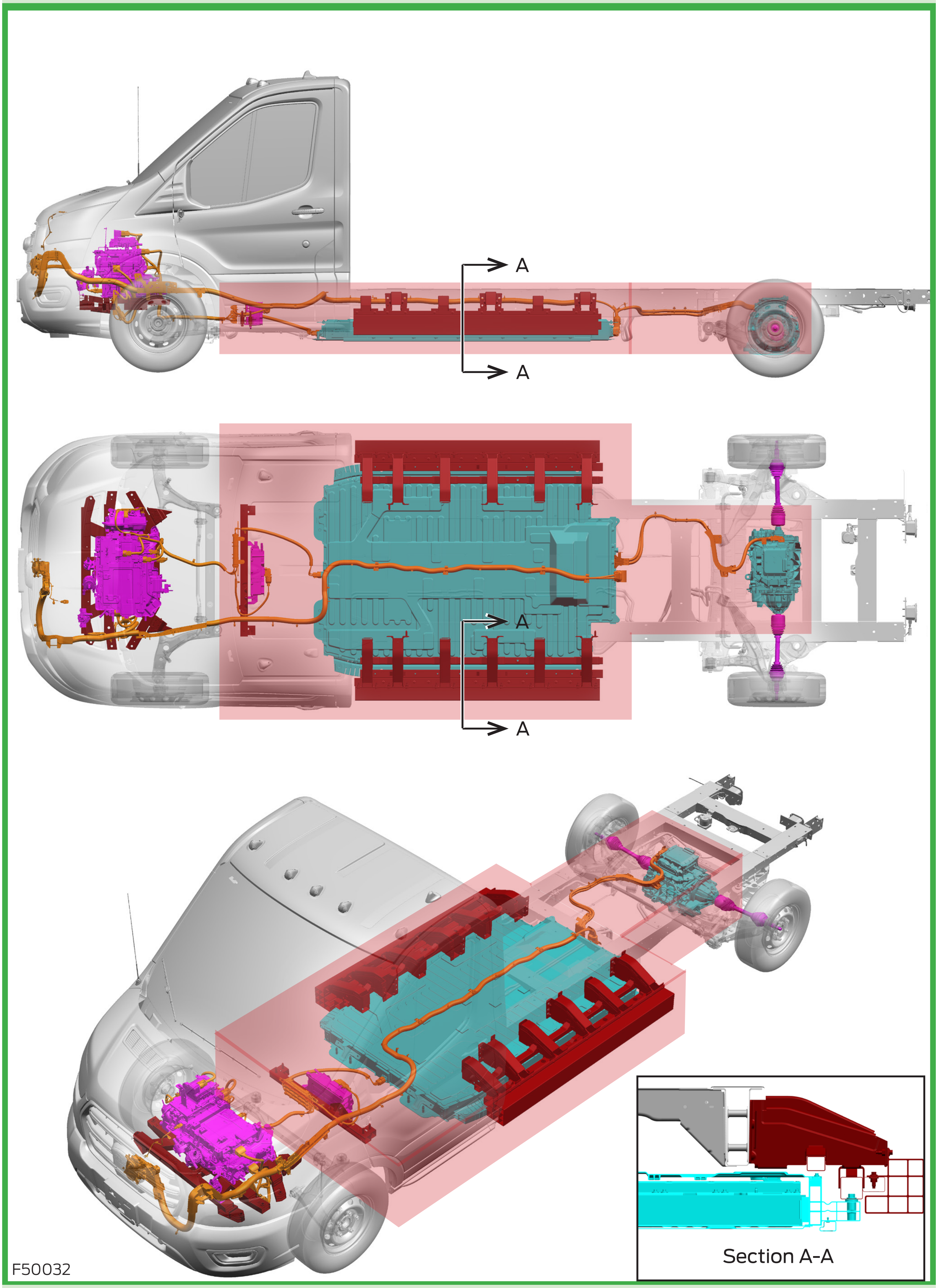
⚠ **Do not ground welding equipment to the Battery, Battery Casing, or Battery Cradle**

Floor No Drill/No Weld Zones - Chassis Cab - Standard Range Battery



🟩 Abc = BEV Only 🟦 Abc = ICE Only

Floor No Drill/No Weld Zones - Chassis Cab - Enhanced Range Battery


A
A
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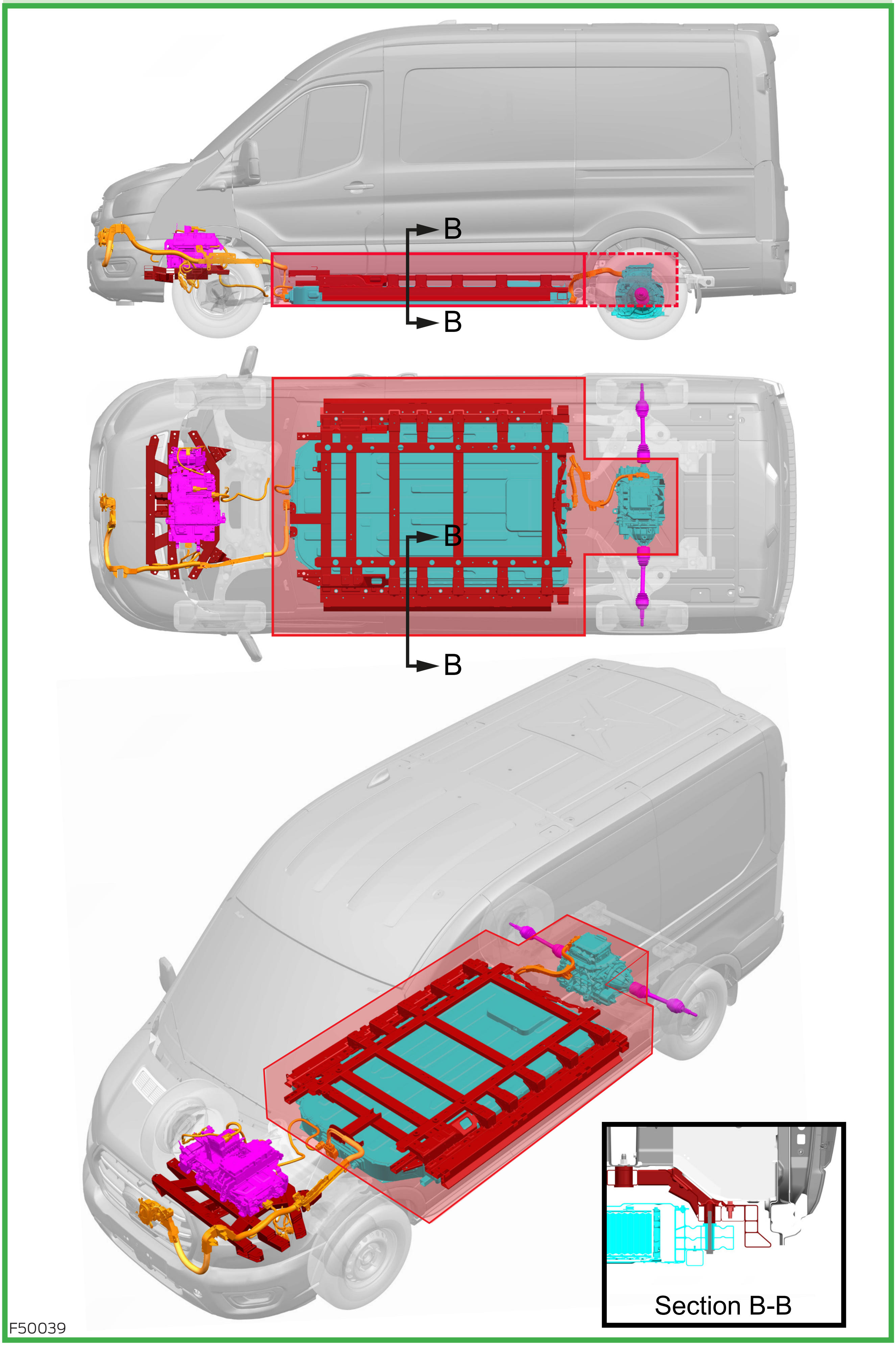
F50032

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Floor No Drill/No Weld Zones: Van, Bus, Kombi - Standard Range Battery



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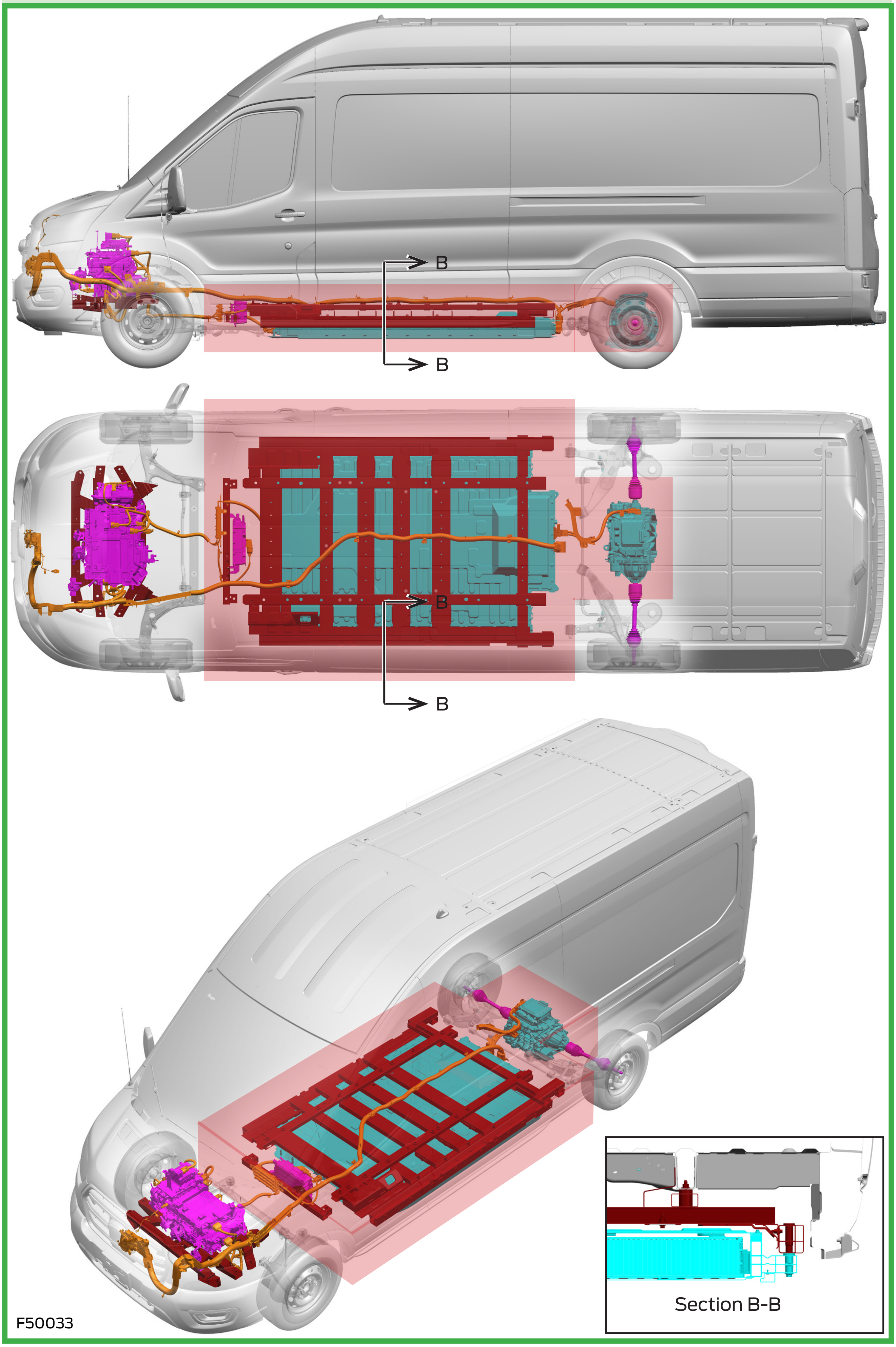
🟩 Abc = BEV Only 🟦 Abc = ICE Only

Floor No Drill/No Weld Zones: Van, Bus, Kombi - Enhanced Range Battery



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5.1.6 BEV Van Floor Drilling

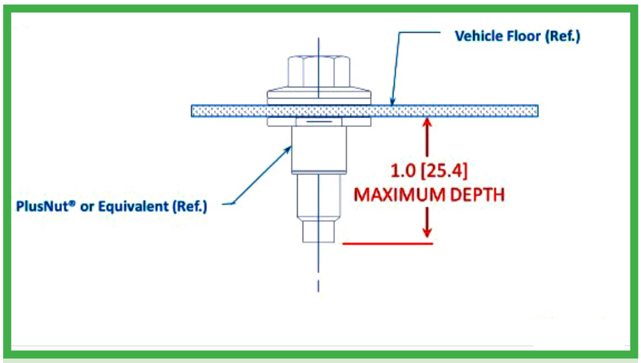
Whilst it is recommended that no drilling is undertaken in the marked zones in **Section 5.1.5,** some limited drilling and fixing is permissable on the cargo floor area of the BEV Van variant; providing the following guidelines are explicitly followed:

It is STRONGLY recommended that E-Transit Van CAD is obtained for upfitter use to understand vehicle component placement/location of High/Low voltage wire harness routing, coolant line routing, hydraulic brake line routing, rear drive unit placement, etc. CAD can be obtained from **Ford Body Builder Advisory Service** by emailing bbasqa@ford.com

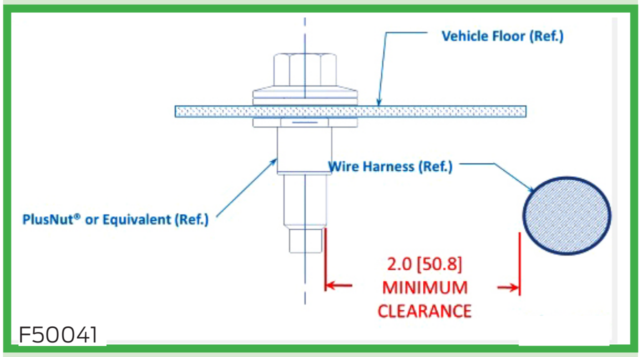
Figures C and D show a marked area on the MWB/LWB Van Cargo Area Floor that indicates the paths of Low/High Voltage Cables, Coolant Lines, Brake Lines and the location of the Battery/Cradle and Electric Drive Assembly. **It is strongly recommended that no drilling or fixing should take place within this area**.

Take precautions when undertaking drilling, or any other operation, aft of B-Pillar in order to prevent damage to any components under the Van floor. HV grounding points in the vehicle are not to be touched:

- When adding holes/fasteners to the floor of the vehicle to secure upfits, consideration must be given to all components below the floor.
- It is strongly recommended that drill-depth stops be used. Drill stop depth shall not exceed 1.0” [25.4mm] MAXIMUM DEPTH
- Fasteners (including PlusNut® or equivalent) extending below the floor of the vehicle shall not exceed 1.0” [25.4mm] MAXIMUM DEPTH (Figure F50040))



- Fasteners (and/or alternative fastening method) extending below the floor of the vehicle shall have 2.0” [50.8mm] MINIMUM CLEARANCE to any surrounding High/Low Voltage wiring and/or coolant line routing and/or hydraulic brake line routing to prevent any damage/chafing. (Figure)



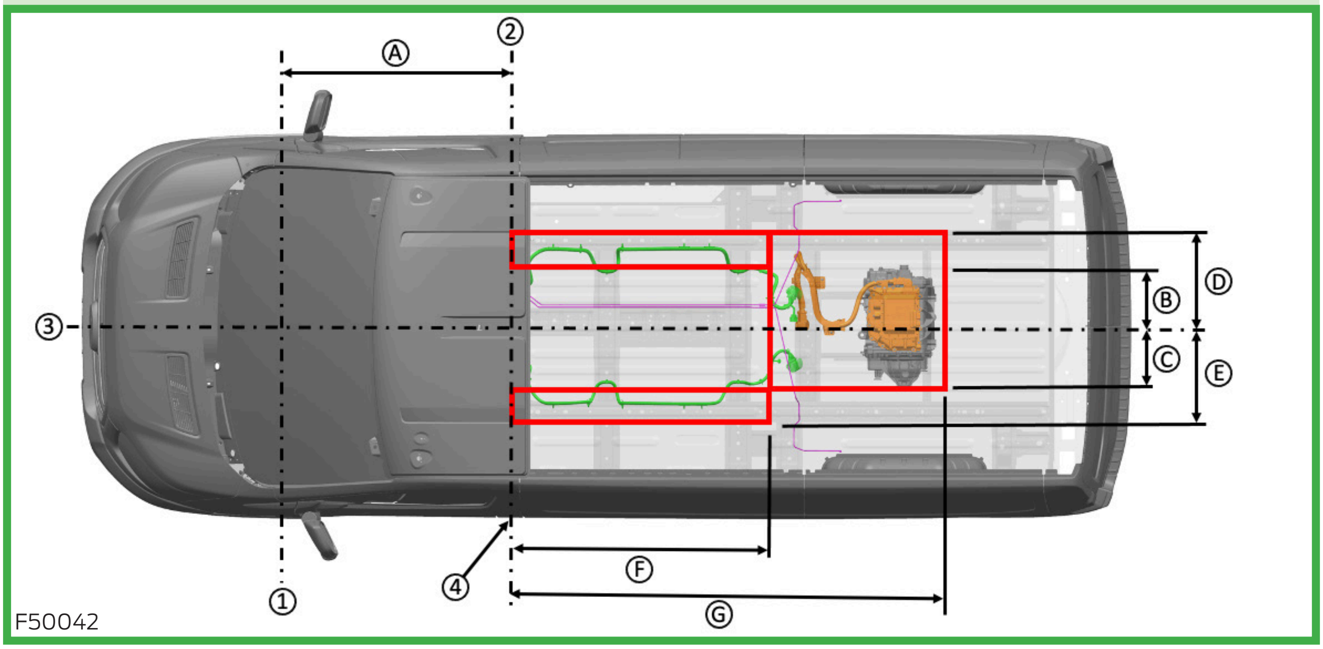
F50041

NOTE: Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection requirements.

NOTE: All fixings through the floor, sides or roof must be sealed.

Refer to:
5.1.1 Body Structures - General Info
5.14 Corrosion Prevention

Precautionary Drill Zones: MWB E-Transit BEV Van Cargo Area Floor - Standard Range Battery

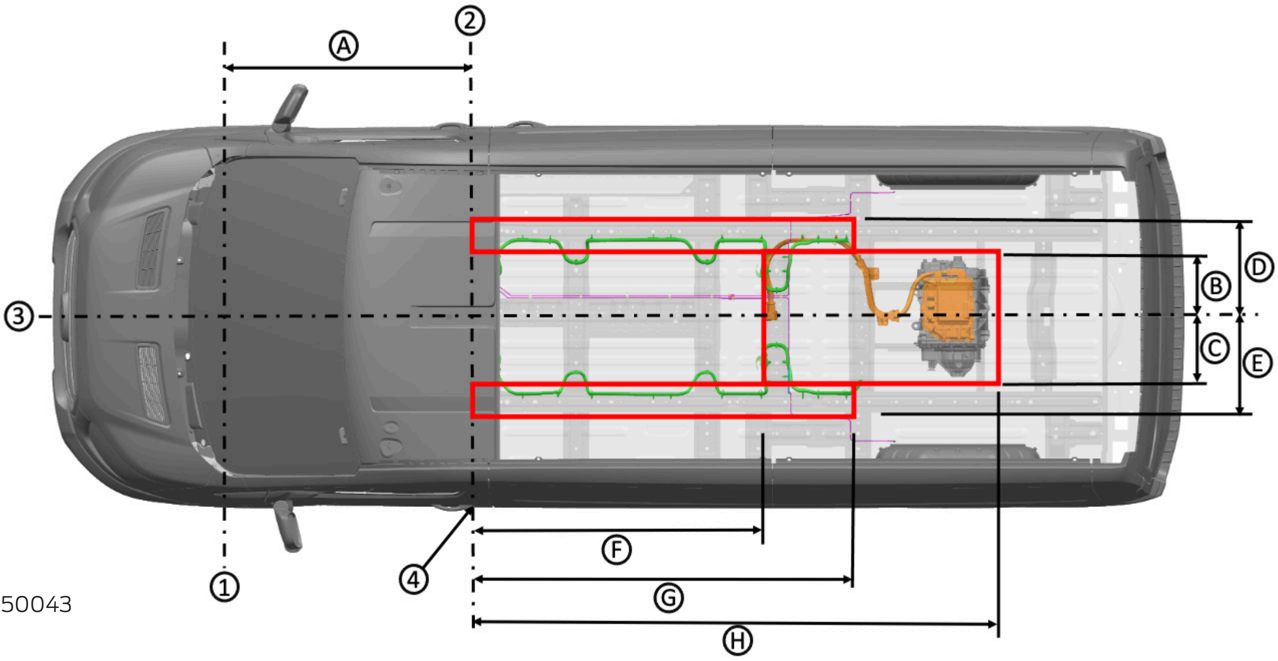


Floor Precautionary Drill Zones			
1	Center Line Front Wheel Axle	C	14”(345mm)
2	Center Line ‘B’ Pillar	D	22”(555mm)
3	Center Line of Vehicle	E	22”(555mm)
4	Fuel Filler - Driver’s Side ‘B’ Pillar	F	50”(1280mm)
A	49”(1235mm)	G	89”(2260mm)
B	14”(345mm)		

Color Key			
🟧	High Voltage Cables	🟪	Brake Lines
🟩	Low Voltage Cables	🟦	Coolant Lines

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Precautionary Drill Zones: LWB E-Transit BEV Van Cargo Area Floor - Standard Range Battery



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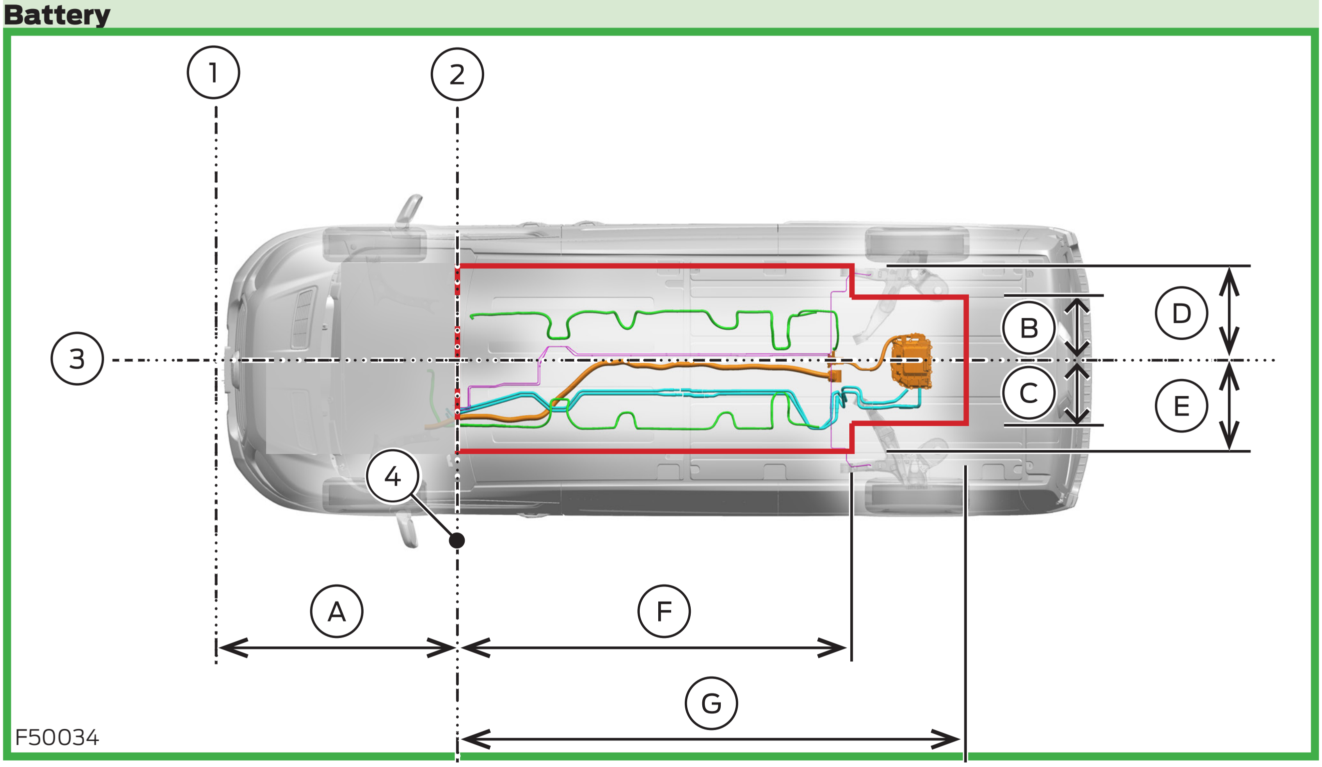
Floor Precautionary Drill Zones			
1	Center Line Front Wheel Axle	C	14”(345mm)
2	Center Line ‘B’ Pillar	D	22”(555mm)
3	Center Line of Vehicle	E	22”(555mm)
4	Fuel Filler - Driver’s Side ‘B’ Pillar	F	59”(1505mm)
A	49”(1235mm)	G	77”(1960mm)
B	14”(345mm)	H	107”(2710mm)

Color Key			
🟧	High Voltage Cables	🟪	Brake Lines
🟩	Low Voltage Cables	🟦	Coolant Lines

🟩 Abc = BEV Only 🟦 Abc = ICE Only

Precautionary Drill Zones: LWB E-Transit BEV Van Cargo Area Floor - Enhanced Range Battery

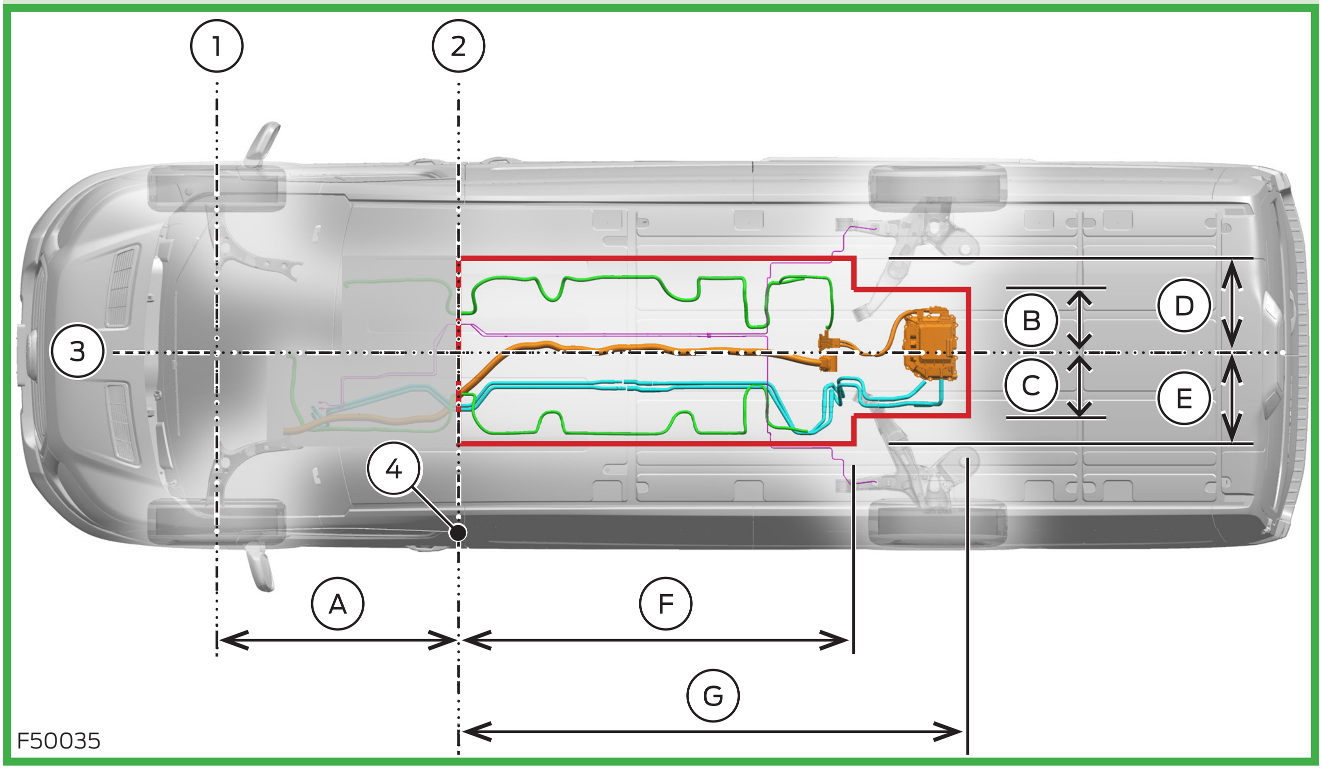


F50034

Floor Precautionary Drill Zones			
1	Center Line Front Wheel Axle	C	14"(345mm)
2	Center Line 'B' Pillar	D	22"(555mm)
3	Center Line of Vehicle	E	22"(555mm)
4	Fuel Filler - Driver's Side 'B' Pillar	F	80"(2032mm)
A	49"(1235mm)	G	107"(2710mm)
B	14"(345mm)		

Color Key			
🟧	High Voltage Cables	🟪	Brake Lines
🟩	Low Voltage Cables	🟦	Coolant Lines

Precautionary Drill Zones: LWB E-Transit BEV Van Cargo Area Floor - Enhanced Range Battery



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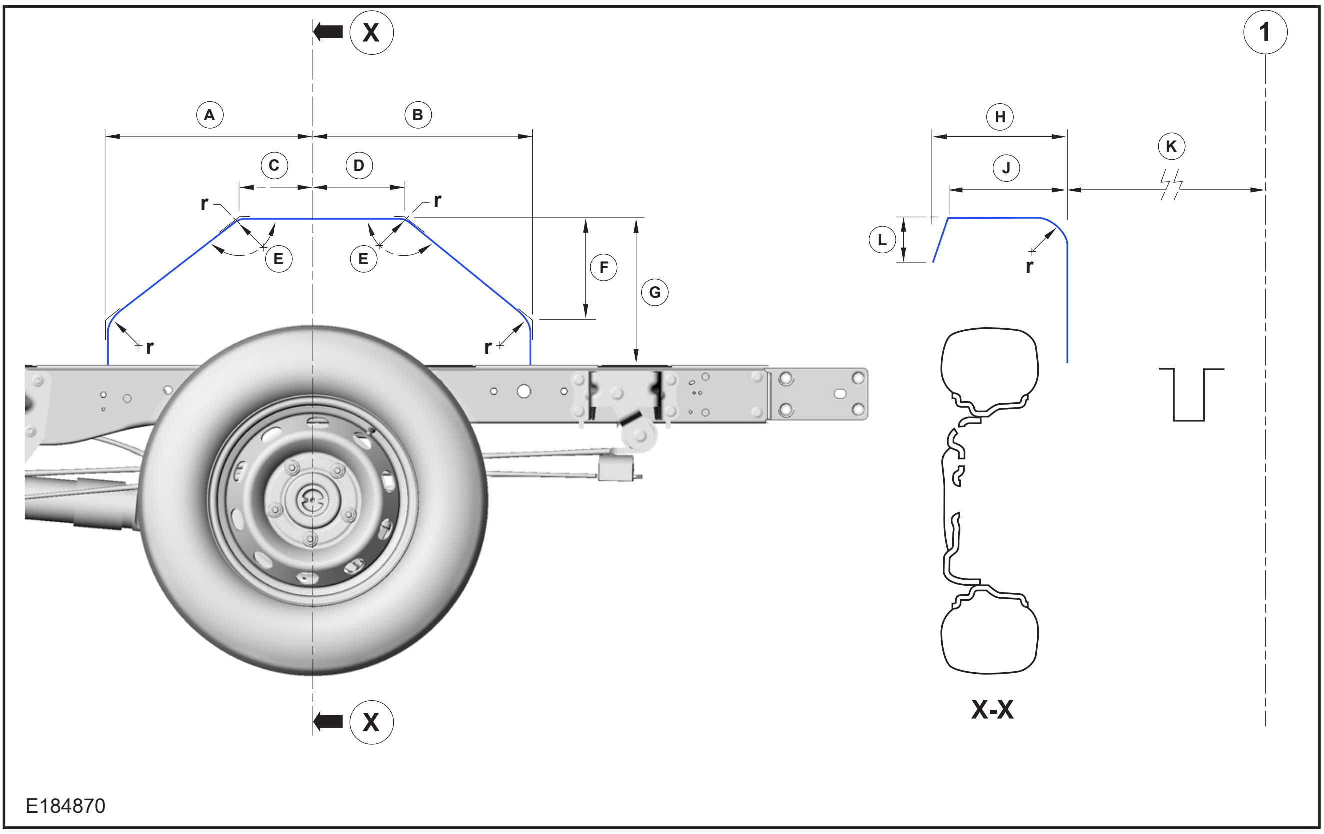
5.1.7 Integrated Bodies and Conversions

For integral structures such as ambulances or motorhomes, with increased rear overhang built onto the chassis, the following applies:

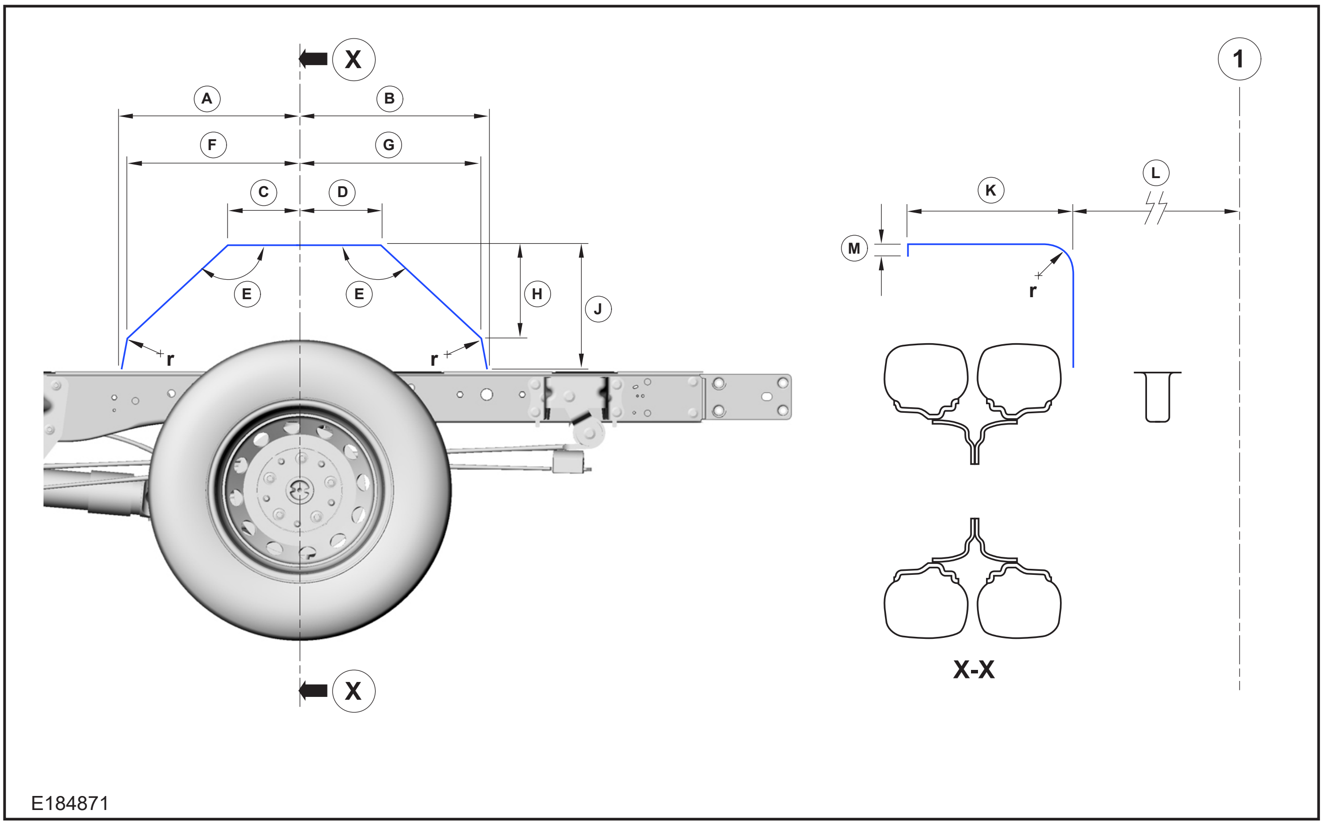
- Reduced departure angles, e.g. rear entry step, should be discussed with the end user/customer. Consider removable components to avoid damage on ferries or lowloaders
- Unique spare wheel stowage may be required if obscured by rear step, check for accessibility
- The recommended dimensions for wheelhouses on conversions are outlined in figures E184870 and E184871
- If a Chassis Cab or Cutaway vehicle is ordered with the optional spare tire, it will be necessary to provide access on the side of the second unit body for spare tire winch access. Alternatively, the spare tire maybe relocated

Chassis Cab/Cutaway with Single Rear Wheel Axle



Wheelhouse Dimensions for Chassis Cab/Cutaway with Single Rear Wheel Axle			
A	16.5” (418mm)	G	10.4” (265mm)
B	17.6” (448mm)	H	10.5” (268mm)
C	6.5” (165mm)	J	9.5” (242mm)
D	7.6” (194mm)	K	27.4” (696mm)
E	141º	L	3.1 (80mm)
F	7.8” (197mm)	r	2.9” (75mm)
1	Center line of Vehicle		
X	Section through Center of Wheelhouse		

Chassis Cab/Cutaway with Dual Rear Wheel Axle



Wheelhouse Dimensions for Chassis Cab/Cutaway with Dual Rear Wheel Drive Axle			
A	16.5” (418mm)	G	17.2” (436mm)
B	17.6” (448mm)	H	7.7” (197mm)
C	6.5” (165mm)	J	10.4 (265mm)
D	7.6” (194mm)	K	15.9” (403mm)
E	141º	L	22.7” (577mm)
F	16” (406mm)	M	1.1” (27mm)
1	Center line of Vehicle	r	2.9” (75mm)
X	Section through Center of Wheelhouse		

5.1.8 Chassis Cab/Cutaway

WARNINGS:

⚠ **Excessive heat can build up from the exhaust system, in particular from the catalytic converter. Ensure adequate heat shields are maintained.**

⚠ **All fixings through the floor, sides or roof must be sealed.**

CAUTIONS:

Uneven load distribution could result in unacceptable handling and braking characteristics.

For E-Transit Battery Electric Vehicle Chassis Cab, conversions behind the B-pillar may exhibit low mass inertia, resulting in longitudinal vibrations of the cabin (nodding). These can be addressed by applying a Tuned Mass Damper, please consult your dealer for availability.

NOTE: E-Transit BEV Single Chassis Cab Variant

If fitting a platform/float/stake style second unit body, Ford Motor Company REQUIRES a Tuned Mass Damper system to be fitted.

The required kit number is KTNK41-110867-A*
When carrying out vehicle conversions/modifications the following points should be considered:

- Make sure that all of the reinforced holes provided in the Chassis/Cutaway frame top surface are used for full length bodies or subframes, see figures E167668, E167669 and E167670.
- Make sure that the vehicle structural integrity is maintained
- Do not drill into closed frame body members
- Make sure that the design for the body alterations or additional structure disperses the load evenly
- Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection legislation

Refer to: 5.14 Corrosion Prevention

- Ensure that any additional equipment in the vicinity of the fuel tank will not damage the tank in a crash condition

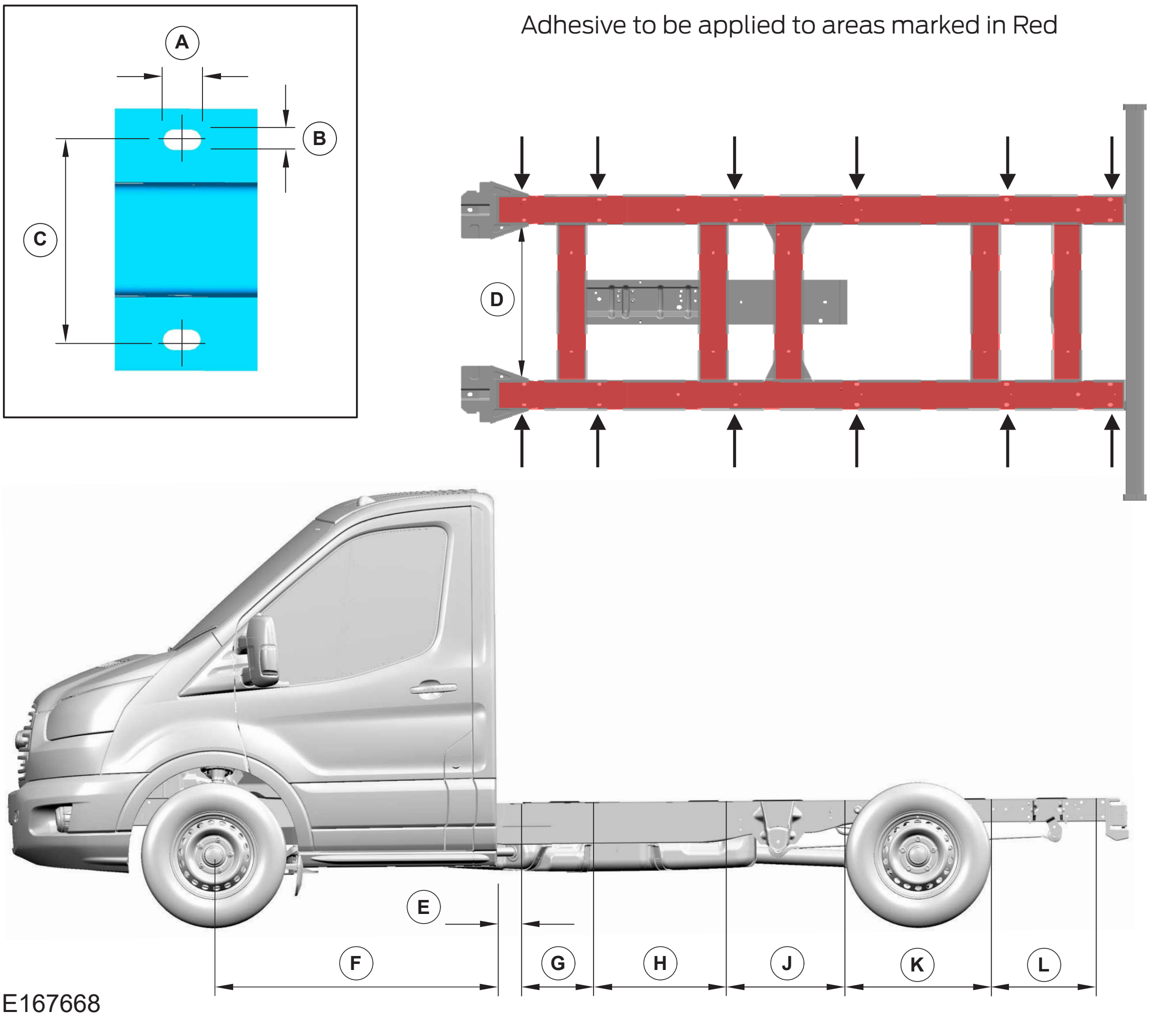
NOTE: The reinforcement plate in cab back panel to chassis member area must be maintained. Do not drill or cut into this area, see figure E167672 later in this section.

For additional information: Refer to: 5.15 Frame and Body Mounting

For any conversion structure attached to - or mounted onto - the base vehicle cab structure, the following applies:

- Ensure that neither the conversion structure nor the existing vehicle structure get pre-loaded by the assembly process
- Adhesive jointing is recommended but should be supplemented with mechanical fasteners to prevent initial peel and long term failure
- When attaching a second unit body on Lightweight Chassis SVO (AALA1) applications, it is mandatory to apply adhesive to the top surface of both chassis rails and all cross members, as well as bolting to the chassis rails at all the existing fixing points. The adhesive specification used must be either a combination of Betaprime 5404 AND Betaseal 1858-1, or an equivalent that meets the material specification, WSS-M11P57-A5.
- Spread bolt loads to minimize local stress

Body Attachment Holes - Chassis/Cutaway Frame Top Flange 138” Wheelbase



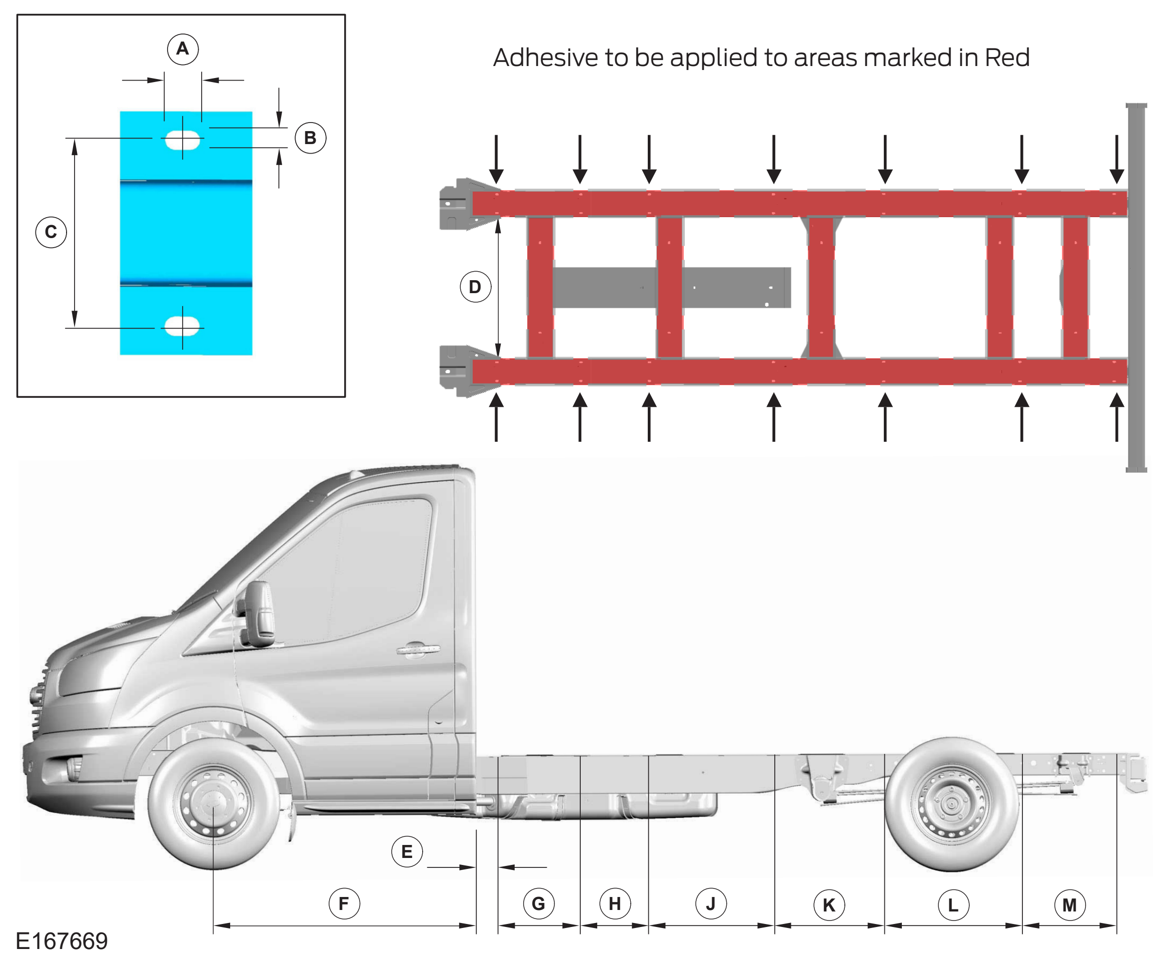
E167668

Body Attachment Holes -Chassis/Cutaway Frame Top Flange 138” Wheelbase			
A	0.7” (19mm)	G	14.5” (367mm)
B	0.4” (11mm)	H	26.2” (665mm)
C	3.9” (100mm)	J	23.3” (592mm)
D	31.5” (800mm)	K	28.7” (730mm)
E	4.2” (108mm)	L	19.9” (506mm)
F	55.4” (1407mm)	-	-

Refer to: 1.10 Package and ErgonomicsVehicle Dimensions for wheelbase dimensions

See Incomplete Vehicle Manual (Standard F/CMVSS 301) for more information

Body Attachment Holes - Chassis/Cutaway Frame Top Flange 156” Wheelbase

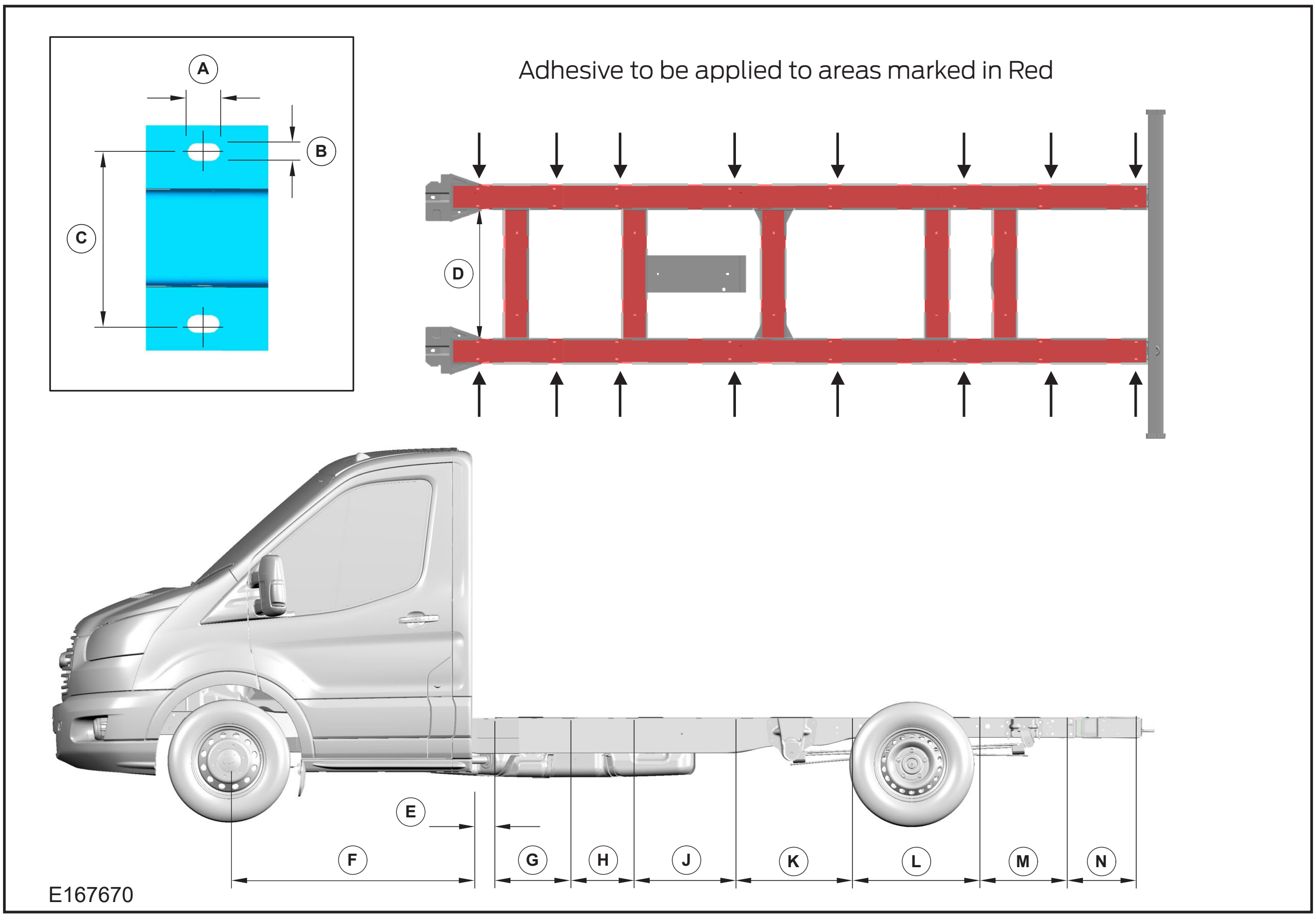

Adhesive to be applied to areas marked in Red

Body Attachment Holes - Chassis/Cutaway Frame Top Flange 156” Wheelbase			
A	0.7” (19mm)	G	17.7” (450mm)
B	0.4” (11mm)	H	14.5” (367mm)
C	3.9” (100mm)	J	26.2” (665mm)
D	31.5” (800mm)	K	23.3” (592mm)
E	4.2” (108mm)	L	28.7” (730mm)
F	55.4” (1407mm)	M	19.9” (506mm)

Refer to: 1.10 Package and Ergonomics Vehicle Dimensions for wheelbase dimensions

See Incomplete Vehicle Manual (Standard F/CMVSS 301) for more information

Body Attachment Holes - Chassis/Cutaway Frame Top Flange 178” Wheelbase

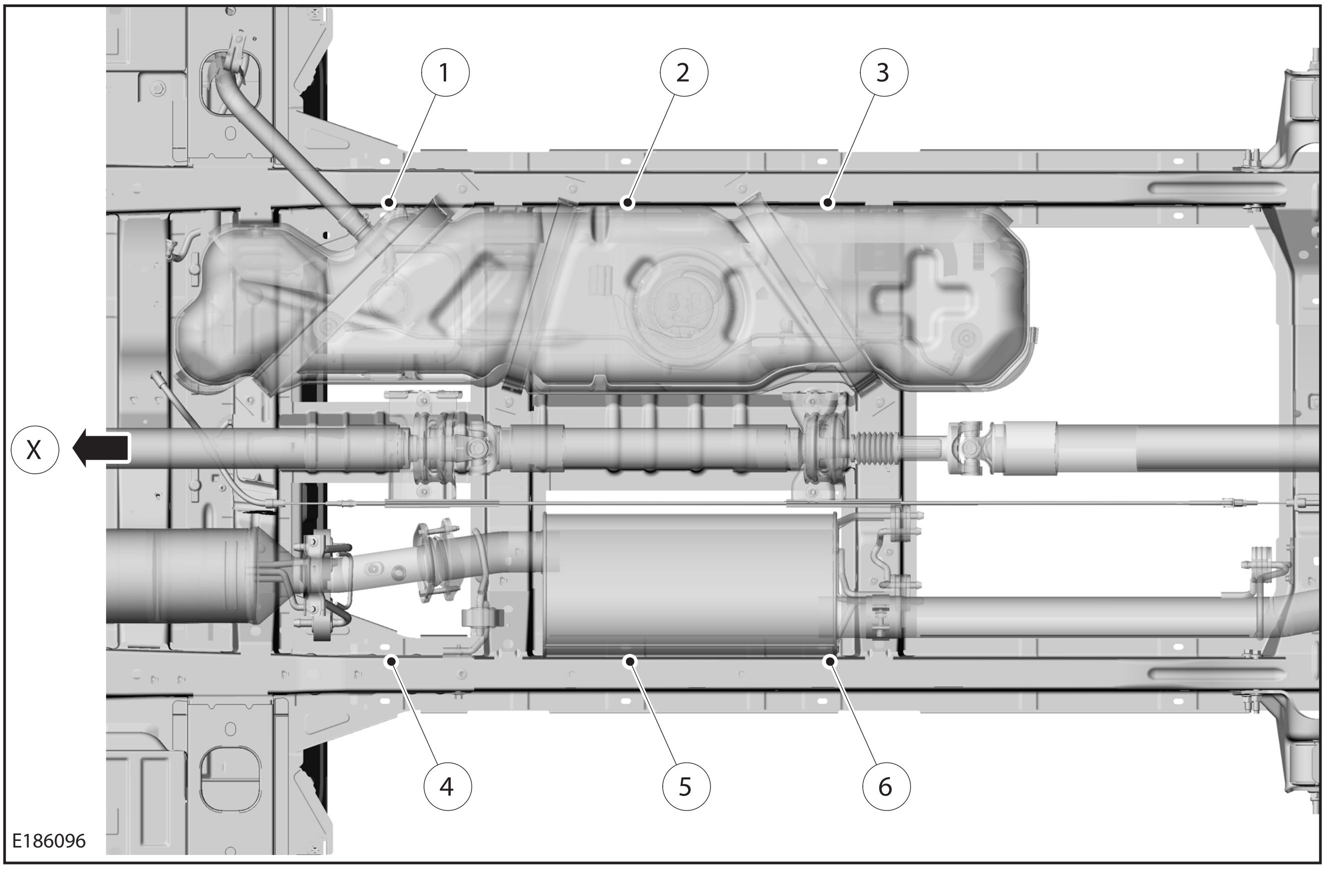

A
B
C
Adhesive to be applied to areas marked in Red
D
E
F
G
H
J
K
L
M
N
E167670

Body Attachment Holes Chassis/Cutaway Frame Top Flange 178” Wheelbase			
A	0.7” (19mm)	H	14.5” (367mm)
B	0.4” (11mm)	J	26.2” (665mm)
C	3.9” (100mm)	K	23.3” (592mm)
D	31.5” (800mm)	L	28.7” (730mm)
E	4.2” (108mm)	M	19.9” (506mm)
F	55.4” (1407mm)	N	22.1”(561mm)
G	17.7” (450mm)	-	-

Refer to: 1.10 Package and Ergonomics Vehicle Dimensions for wheelbase dimensions

See Incomplete Vehicle Manual (Standard F/CMVSS 301) for more information

Recommended Second Unit Body Fitting Strategy (Bottom View)

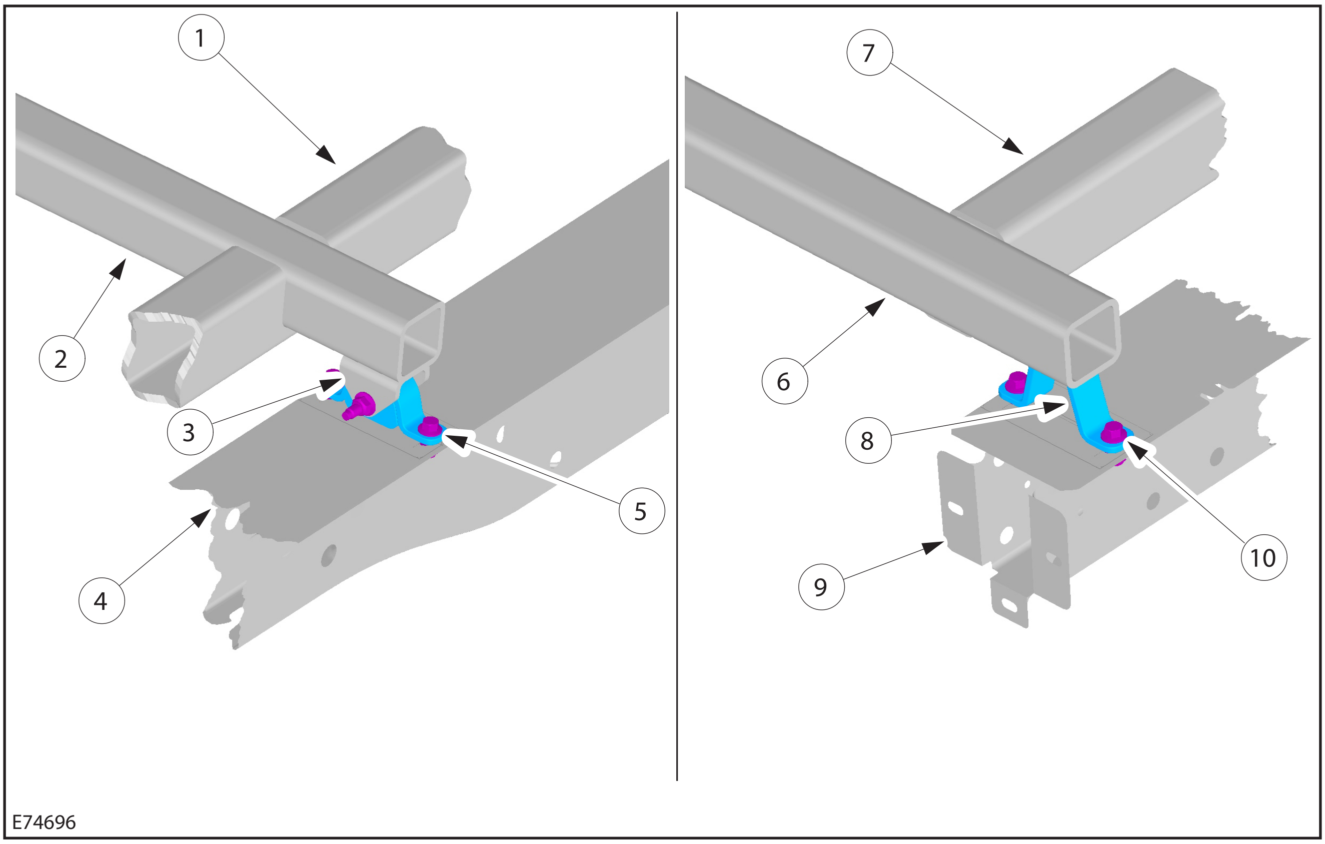


When mounting a Second Unit Body, the attachment holes shown in figures E167668, E167669 and E167670 should be used.

NOTE: Some of the attachment holes are difficult to reach or obscured by the fuel tank, see figure E186096. It is recommended that Inboard attachment points 1 and 4 should always be used, however, attachment points 2,3,5 and 6 can be omitted.

Consult Incomplete Vehicle Manual for further recommendations/requirements

Subframe Attachment to Chassis Frame



Item	Description
1	Subframe Longitudinal
2	Subframe Outriggers
3	Compliant Mount
4	Chassis Frame
5	M10 Bolts and Self Locking Nuts
6	Subframe Outriggers
7	Subframe Longitudinal
8	Solid or Fixed Mount
9	Chassis Frame
10	M10 Bolts and Self Locking Nuts

It is recommended to design subframes in the way that there is no adverse strain on the vehicle structure. Use compliant and fixed mounts to attach to the vehicle body.

Subframe ends must be relieved at forward end to minimize local contact stress concentrations.

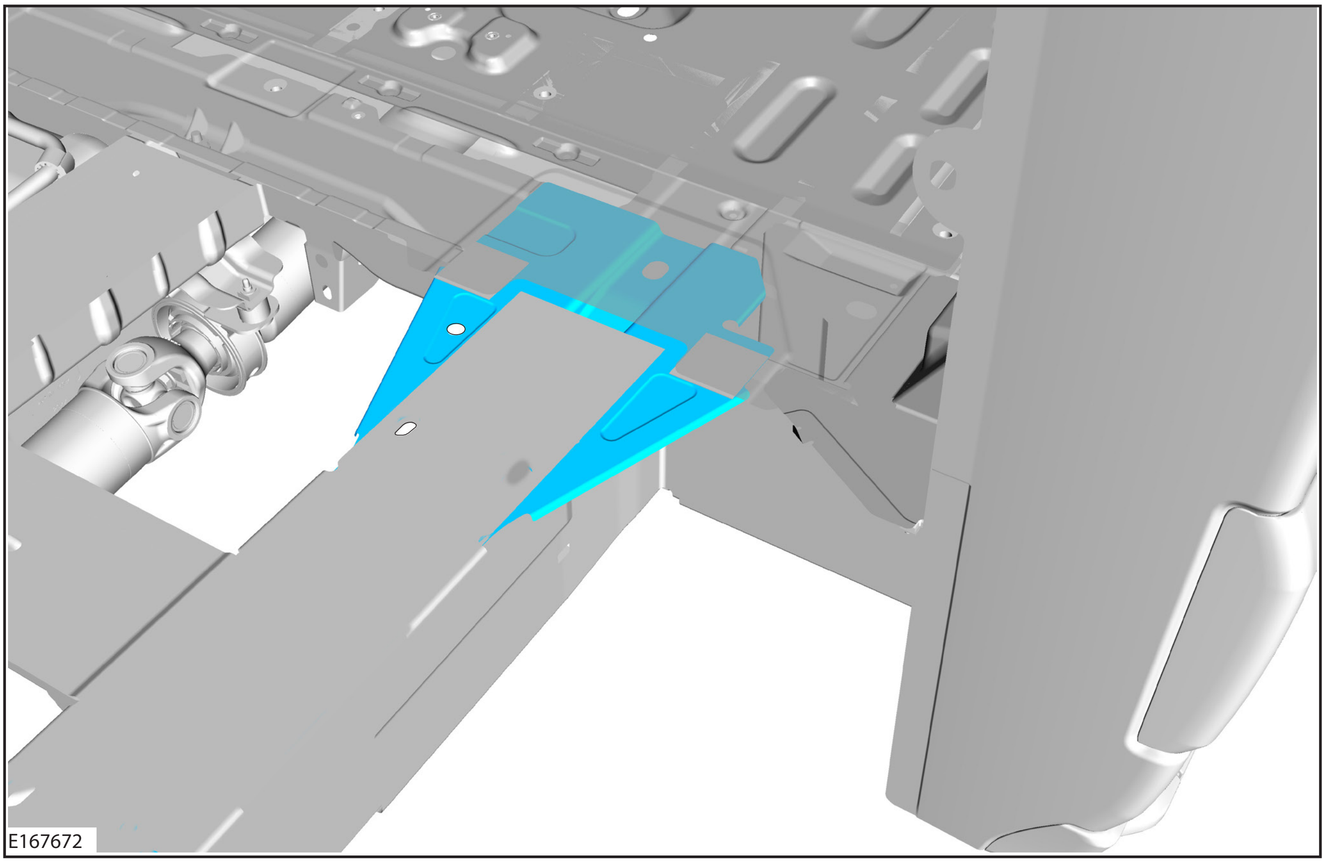
Refer to: 5.15 Frame and Body Mounting

It is recommended to mount the longitudinal brackets with a clearance to the chassis frame top surface.

Stiff subframes, for example closed section longitudinal rigidly connected with similar section cross members, may damage the chassis frame by preventing its natural flexing. Therefore appropriate compliant mounts should be used. Please refer to E74696.

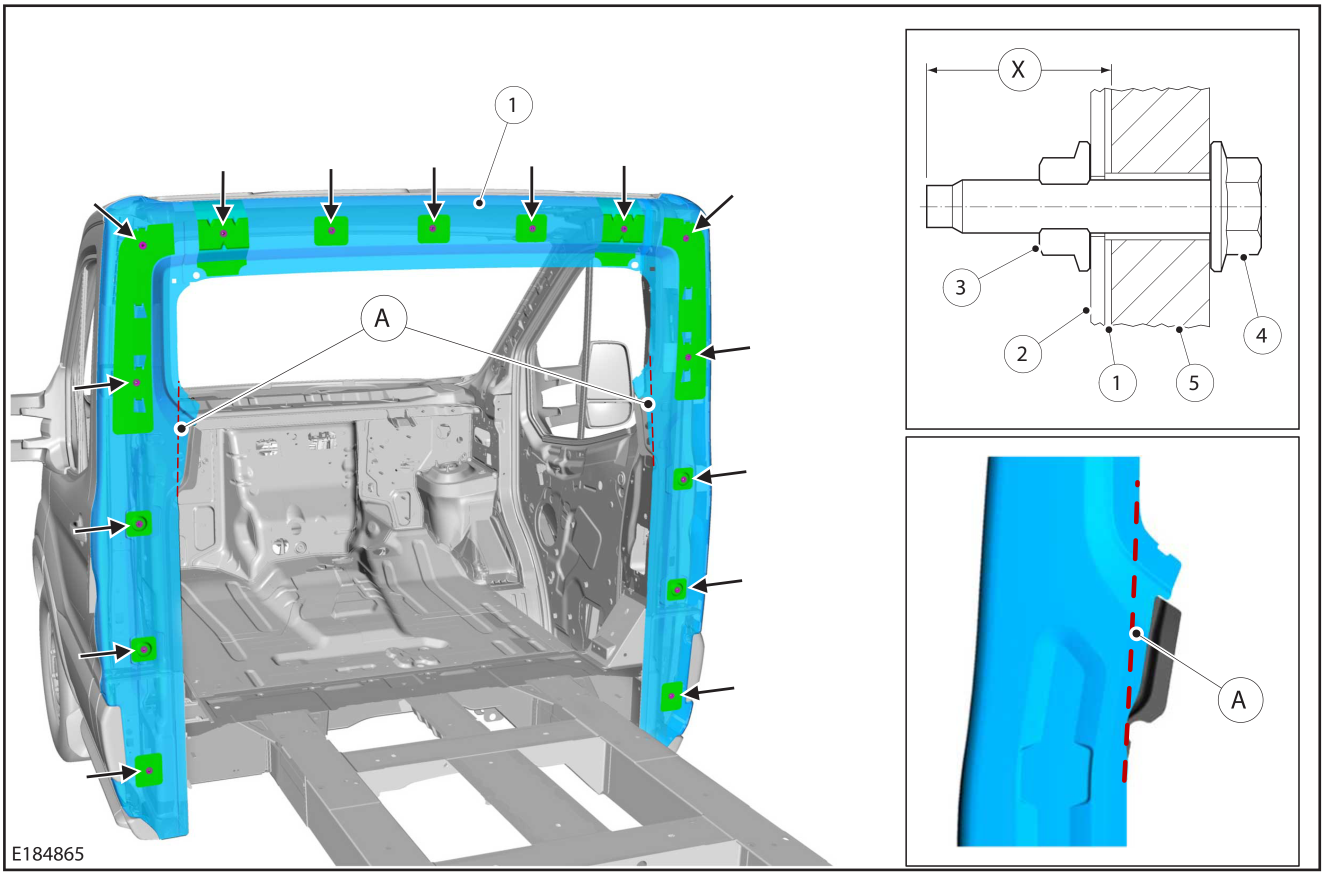
Each set of brackets must use 2 x 10 bolt grade 8.8 minimum.

Reinforcement Plate on Single Chassis Cab Vehicles



Do not drill or cut in the reinforcement plate on single chassis cab/cutaway vehicles.

5.1.9 Cutaways



E184865

Item	Description
A	Flange trim line
1	Cutaway flange with added reinforcement
2	Reinforcement plate (see positions arrowed)
3	Non threaded weld nuts (15x see positions arrowed)
4	Use MR8 TAPTITE 2000® bolts - not supplied (15x positions) or equivalent size, gauge, self tapping fastner.
5	Second Unit Body
X	Maximum intrusion 1” (25mm)

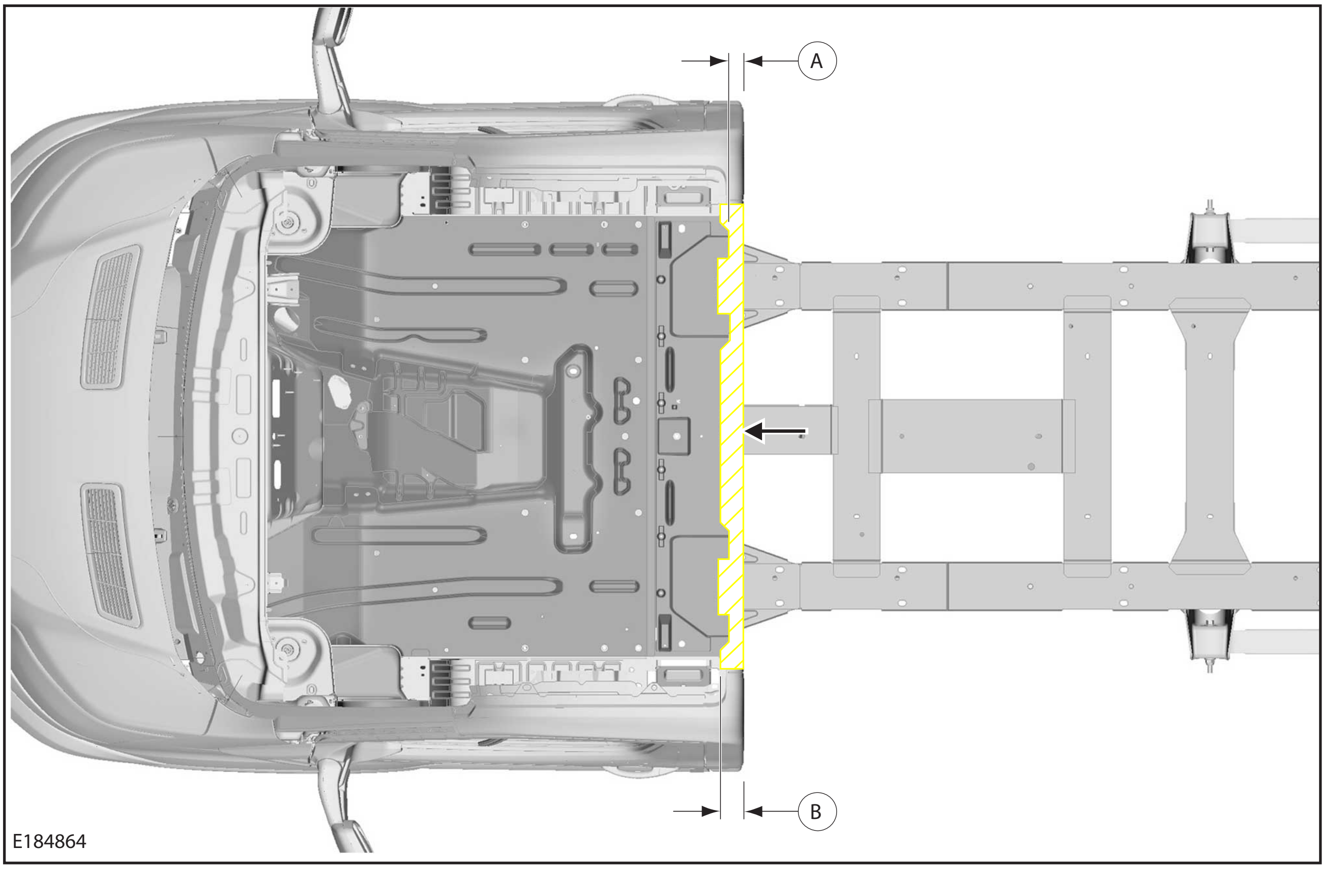
NOTE: When trimming the edge, do not cut further outboard than the trim line ‘A’ (Left hand side shown, right hand side symmetrically opposite) as shown in figure E184865. Do not cut outboard of the last spotweld joining the 2 panels together on each flange. The cut must be more than 0.2” (5mm) away from the last weld.

For attaching a second unit body to the Cutaway cabin, fifteen weld nuts are provided, see figure E184865. All fifteen weld nuts must be used. The bolts must not exceed 1” (25.4mm) intrusion into the vehicle cabin structure.

NOTE: If implementing a fully sealed body, a minimum of 23.3in² (150cm²) air extraction cross sectional area is required on each side of the vehicle cab. An ideal position for the extractors would be in the back panel of the cab.

If this is not feasible, then extractors should be situated rearward of the B-pillars such that there is a free airflow path equating to at least the minimum extractor effective cross sectional area, both upstream and downstream of each extractor, to maintain windshield defogging performance and door closing efforts. Extraction should not be installed near exhaust components nor areas exposed to potential fuel spillage.

Cutaway - Floor Spacer



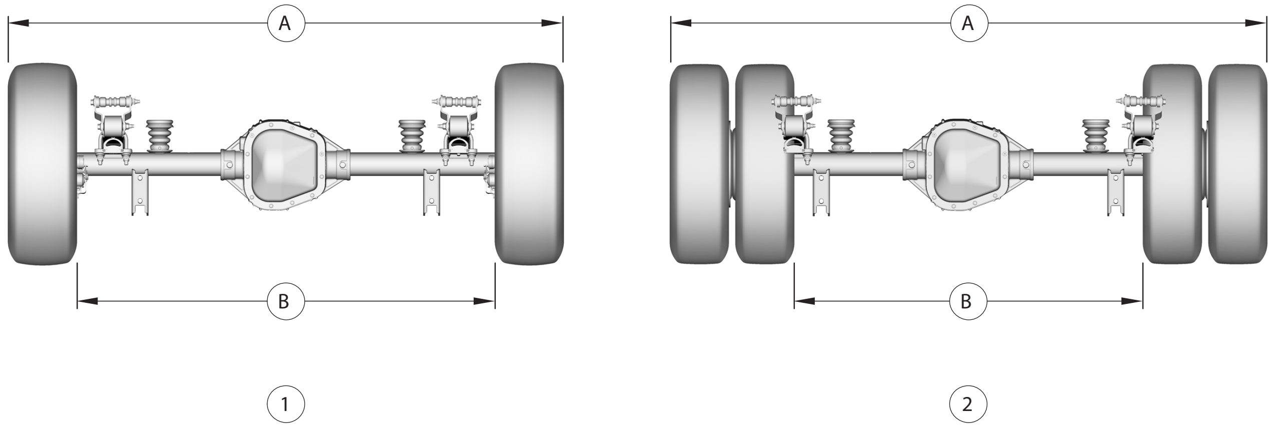
Item	Description
A	1.8” (45mm)
B	3.1” (77mm)

Cross hatched area shown in figure E184864 is a floor gap and will require a spacer plate (not supplied) to close off the gap on Cutaway vehicles for certain types of upfits including box vans, utility bodies and similar.

NOTE: Check Precautionary Drill Zones for the fuel tank before fitting a spacer plate.

NOTE: Added spacer and attachments through the floor must be sealed for water/exhaust fumes.

Cutaway Rear Axle



E185648

Chassis Cab/Cutaway Rear Axle			
Single Rear Wheel (1)		**Dual Rear Wheel (2)**	
A	78.3” (1987mm)	A	83.1” (211mm)
B	59” (1498mm)	B	48.4” (1230mm)

5.1.10 Front End Integrity for Cooling, Crash, Aerodynamics and Lighting

Cooling: Continuous air flow through the front end and engine compartment is not to be hindered by adding any additional equipment.

Lighting: Do not alter the lighting system.

Crash: Do not cut, drill or weld any parts that are load path relevant in case of crash. Do not add material in the crash zone. This could affect the crash sensor calibration.

The side airbag system is not permitted if:

- A swivelling device is fitted on the front seats
- Any additional material or structure is attached to the ‘B’ pillar inner and/or outer area

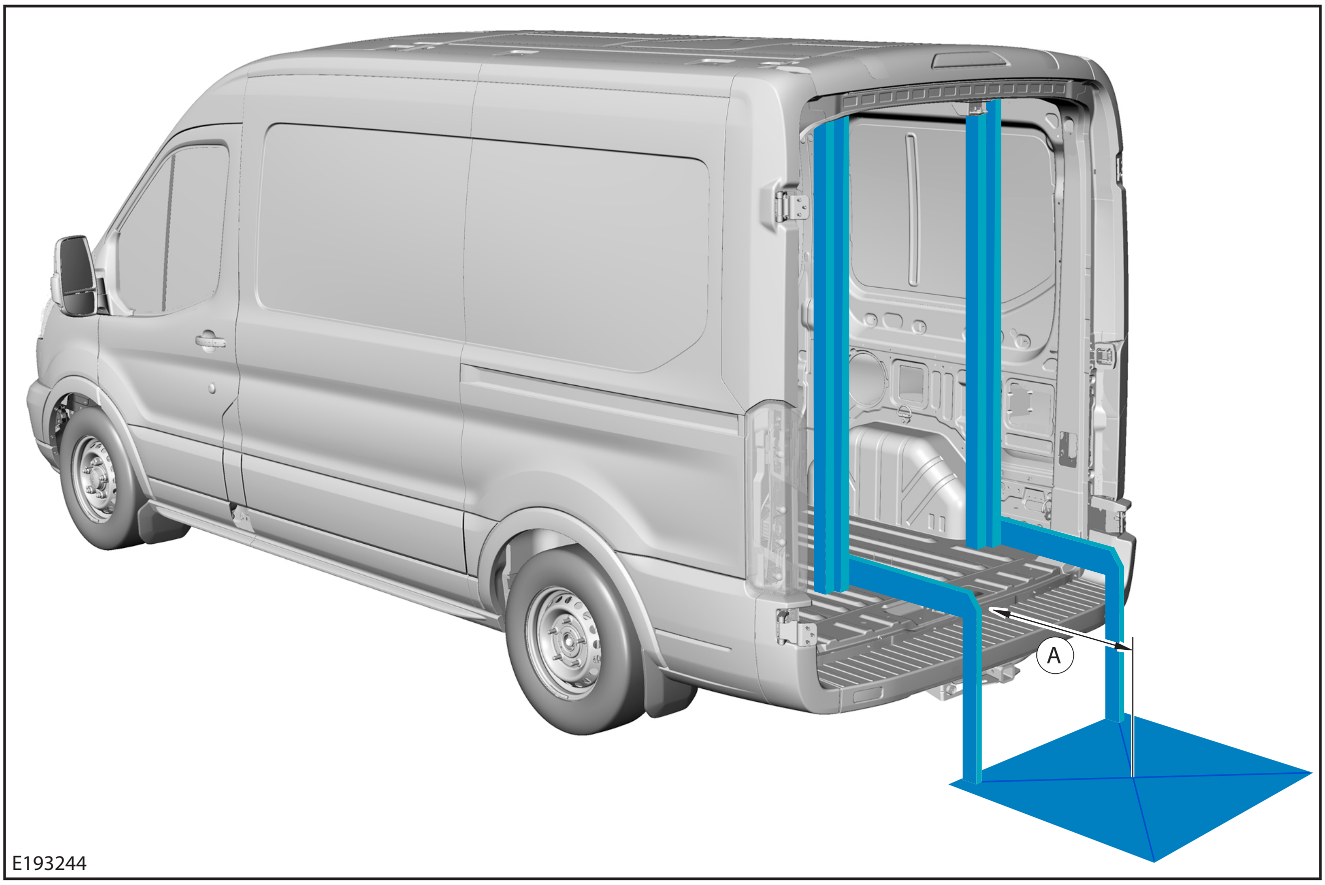
Aerodynamics All aerodynamic drag reduction devices should not hinder the performance of cooling system, lighting and crash requirements.

For a summary of aerodynamic drag reduction device refer to BBAS website: https://fordbbas.com/

Installation of the drag reduction devices should comply with the “no drill zone” requirement.

5.2 Hydraulic Lifting Equipment

5.2.1 Hydraulic Liftgate



Item	Description
A	39” (1000mm)

It is recommended to fix lift framework on bottom and on top side by using reinforcing plates and through bolts. It is also recommended to design and/or locate the reinforcing plates in a way that load can be routed into adjacent reinforced body structure.

Hydraulic underslung tail lifts are not recommended for Transit Van or Wagon.

For Chassis Cab and Cutaway with tail lift design it is recommended to use unique body sub-frame for fixing to Chassis Cab and Cutaway structure.

5.3 Racking Systems

5.3.1 Racking Systems

WARNING: Racking Systems should not be designed in a way that allows for the Center of Gravity to be raised beyond specified limits.

Refer to: 1.12 Load Distribution

WARNING: Racking that is added must be designed to enable the user to secure items on the rack to avoid items shifting during motion.

For attaching a racking system, it is recommended to use the marked areas shown in figure E192242.

NOTE: Upper fixing locations are not structural and take a 30kg maximum load only.

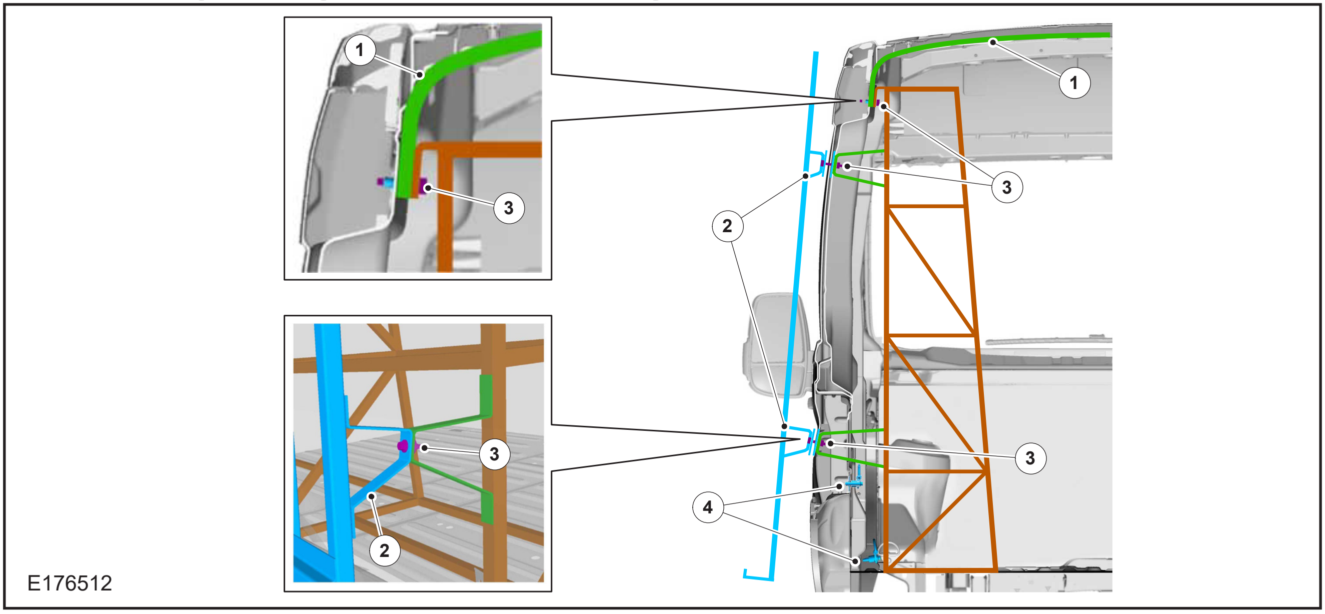
- Frames should be rigid, self-supporting and bolted through the floor, use reinforcements on the underfloor
- It is not recommended to drill through the floor in combination with plastic load floor liners
- For alternatively fixing through the floor to the side members, refer to Frame and Body Mounting section of this manual, Frame Drilling and Tube Reinforcing.
  Refer to: 5.15 Frame and Body Mounting
- Load compartment tie downs can also be used for additional fixing locations.
  Refer to: 5.4 Loadspace
- Ensure proper sealing against ingress of water, salt, dust, after cutting or drilling the body. Use Ford approved sealing and finishing materials, and underbody corrosion protection
- To minimize stress in body side upper area, additional cross brace roof bows are to be used
- If linings are planned for the inside of the load area, all racking through bolts must be designed to be accessible through the lining to the body structure with spreader plate
- No load bearing fixing to the lining only
- For increased crash performance the racking system should be designed with diagonal reinforcements
- Vehicle should be equipped with a bulkhead to give best protection to driver and front passengers
- Preferably, there should be a rack each side to balance the vehicle load

Refer to: 5.4 Loadspace

For additional information
Refer to: 5.14 Corrosion Prevention

For additional information on No Drill Zones
Refer to: 4.2 Wiring Installation and Routing Guides
Refer to: 5.1 Body
Refer to: 5.6 Body Closures

Glass Carrying Racking - Recommended Fixing Locations



Item	Description
1	Full width cross bow brace.
2	Load bearing attachments, through body side to internal structure (2x minimum top and bottom).
3	Through bolts.
4	Load compartment tie down loops.

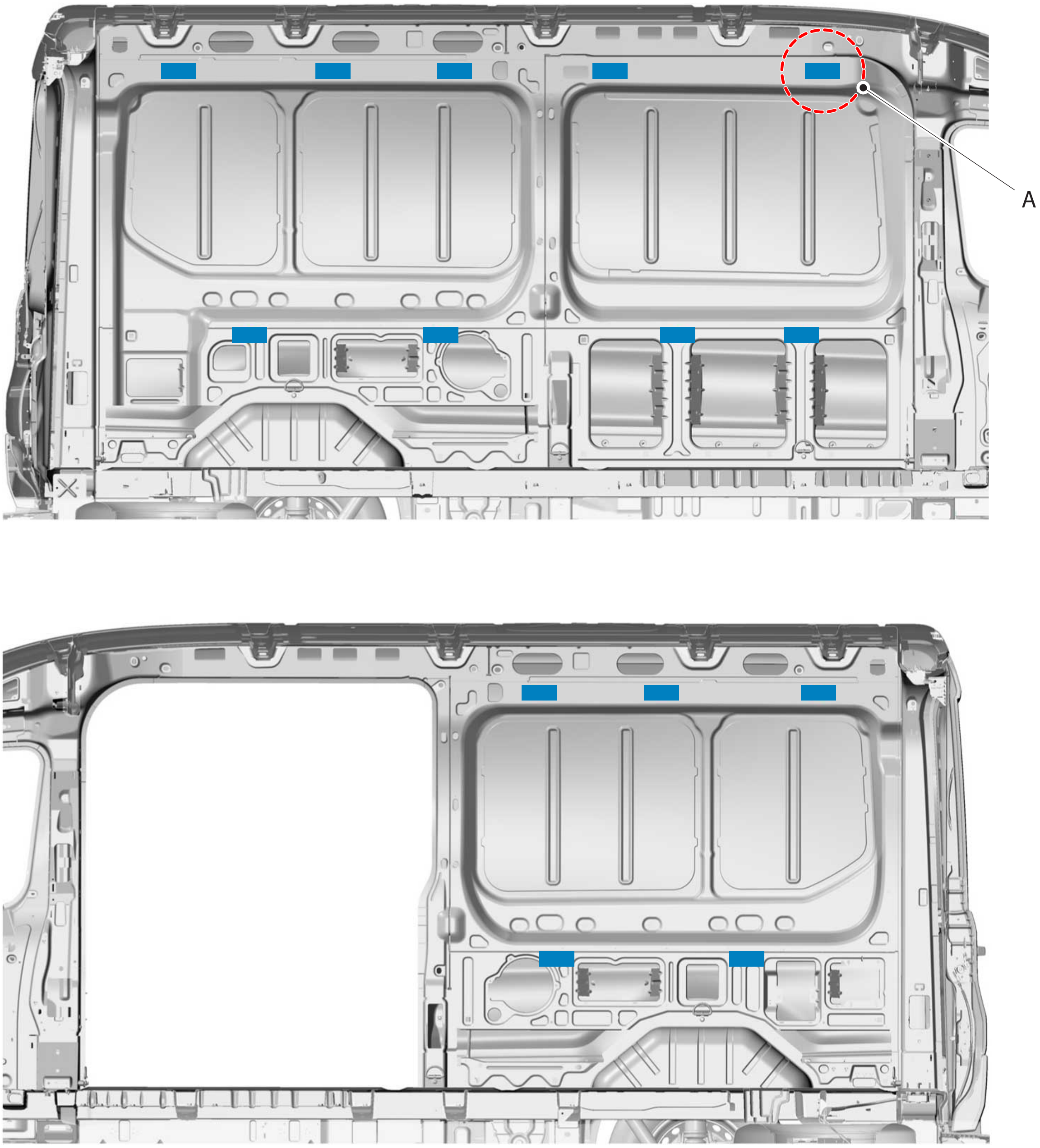
Glass Racking on Outside of Van - Through Fixed to Internal Strong Structure (Recommended Minimum)

Glass Racking on Outside of Van

For designing glass carrying rack on body side outer, construct internal structure and bolt through the body side to the internal structure, using the recommended fixing locations, see figures E192242 and E176512, or load compartment tie downs.
For designing glass carrying rack on bodyside outer, the following unique requirements are recommended:

- Construct the internal structure and bolt through the body side to the external structure, see figure E176512
- Internal structures should be rigid, self-supporting and bolted through the floor. Use reinforcements on the underfloor
- Avoid the no-drill zones when selecting fixing locations.
  Refer to: 4.2 Wiring Installation and Routing Guides
- It is recommended to balance the vehicle load.
  Refer to: 1.12 Load Distribution
- Distribute the force equal to the fixed structure

Recommended Fixing Locations (Medium Roof shown)

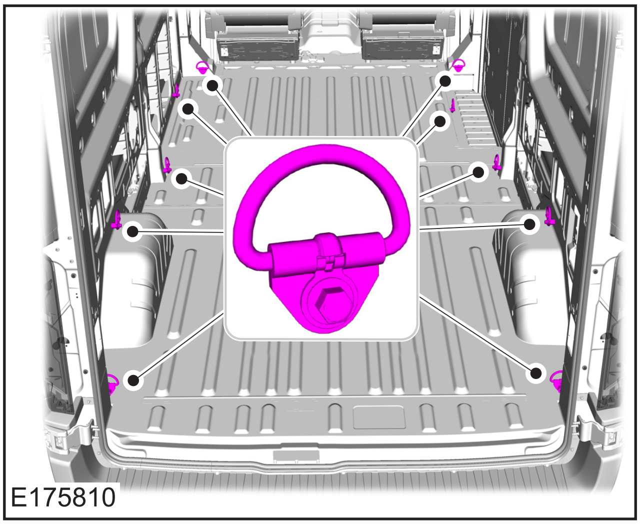


Item	Description
A	Low Roof Vehicles do not have this fixing location

5.4 Loadspace

All vehicles are fitted with load compartment tie downs, these are all ‘D’ rings as shown in E175810. Not all vehicles will have all locations shown, it will depend on the base vehicle.

Refer to: 5.3 Racking Systems



E175810

5.5 Internal Partitions/Bulkhead

Driver and Front Passenger(s) Protection on Van, Bus

⚠ **WARNING: Do not obstruct any of bulkhead vents.**

It is the Vehicle Convertor’s responsibility to ensure local current legislation, governing bulkheads and protective window grilles, is met. It is also the Convertor’s responsibility to ensure legal load constraint requirements if using a non Ford standard bulkhead.

For further information please go to the **Body Builders Advisory Service**, https://fordbbas.com, or email bbasqa@ford.com

5.6 Body Closures

5.6.1 Security, Anti-Theft and Locking System

CAUTION: To avoid locking system security complications, it is recommended to discuss with your local Ford dealer prior to conversions taking place.

NOTE: It is not recommended to alter the locking system or damage the security shielding around the lock and latch.

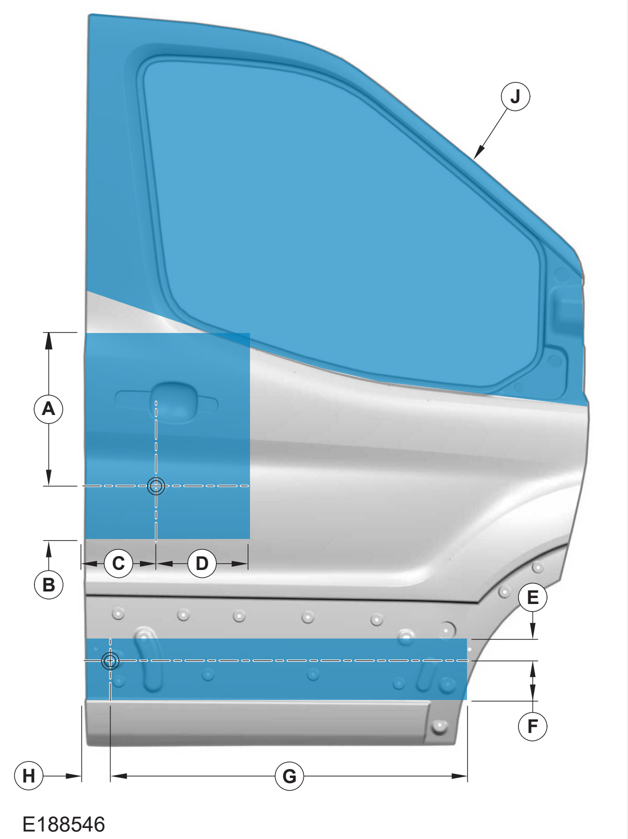
To avoid locking system security complications, it is recommended to discuss with the local Ford dealer prior to modifications taking place.

When removing and reapplying door seals, take care to fit correctly using the same seals, as this is critical to door closing efforts. Any modification to the sealing flanges or surfaces will require consultation with your local Ford dealer. This may also include air extraction/venting adjustments to assist door close efforts if significant changes to closures are required.

The Body Control Module is designed to work specifically with the Ford Transit lock and latch mechanisms and therefore drives latches to lock and unlock for specific time periods. Additional power locking functionality should be based around the use of additional Ford Transit latch mechanisms. Additional latches can be driven via relays connected in parallel with existing latches.

The following figures outline the areas in which it is not advisable to drill.

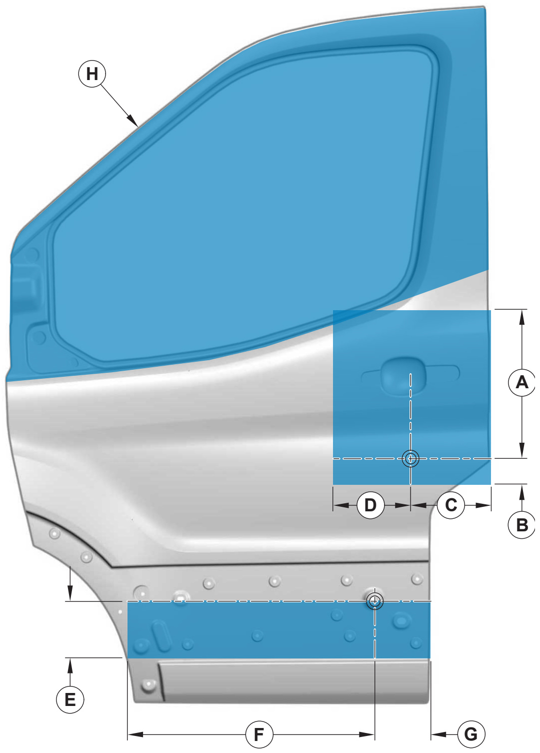
No Drill Zone - Right Hand Side Door



Item	Description
A	16.93” (430mm)
B	1.97” (50mm)
C	7.87” (200mm)
D	5.91” (150mm)
E	0.79” (20mm)
F	3.15” (80mm)
G	31.5” (800mm)
H	2.56” (65mm)
J	No drill zone - Airbag deployment

🟩 Abc = BEV Only 🟦 Abc = ICE Only

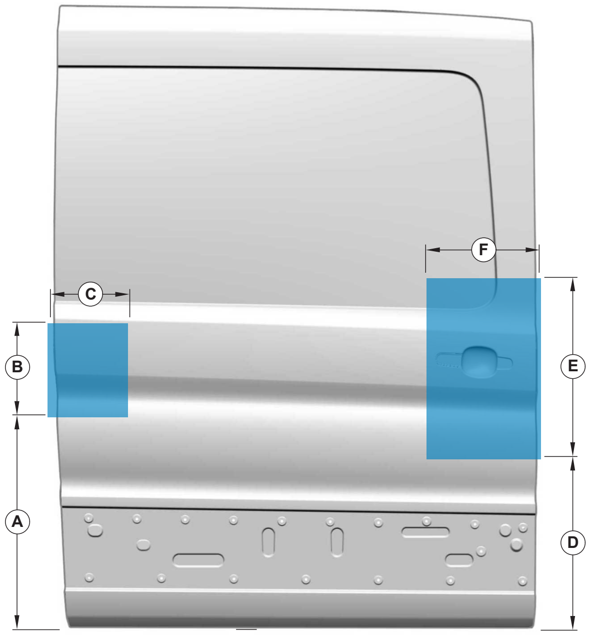
No Drill Zone - Left Hand Side Door



E188547

Item	Description
A	16.93” (430mm)
B	1.97” (50mm)
C	7.87” (200mm)
D	5.91” (150mm)
E	3.94” (100mm)
F	23.62” (600mm)
G	2.76” (70mm)
H	No drill zone - Airbag deployment

No Drill Zone - Side Sliding Doors

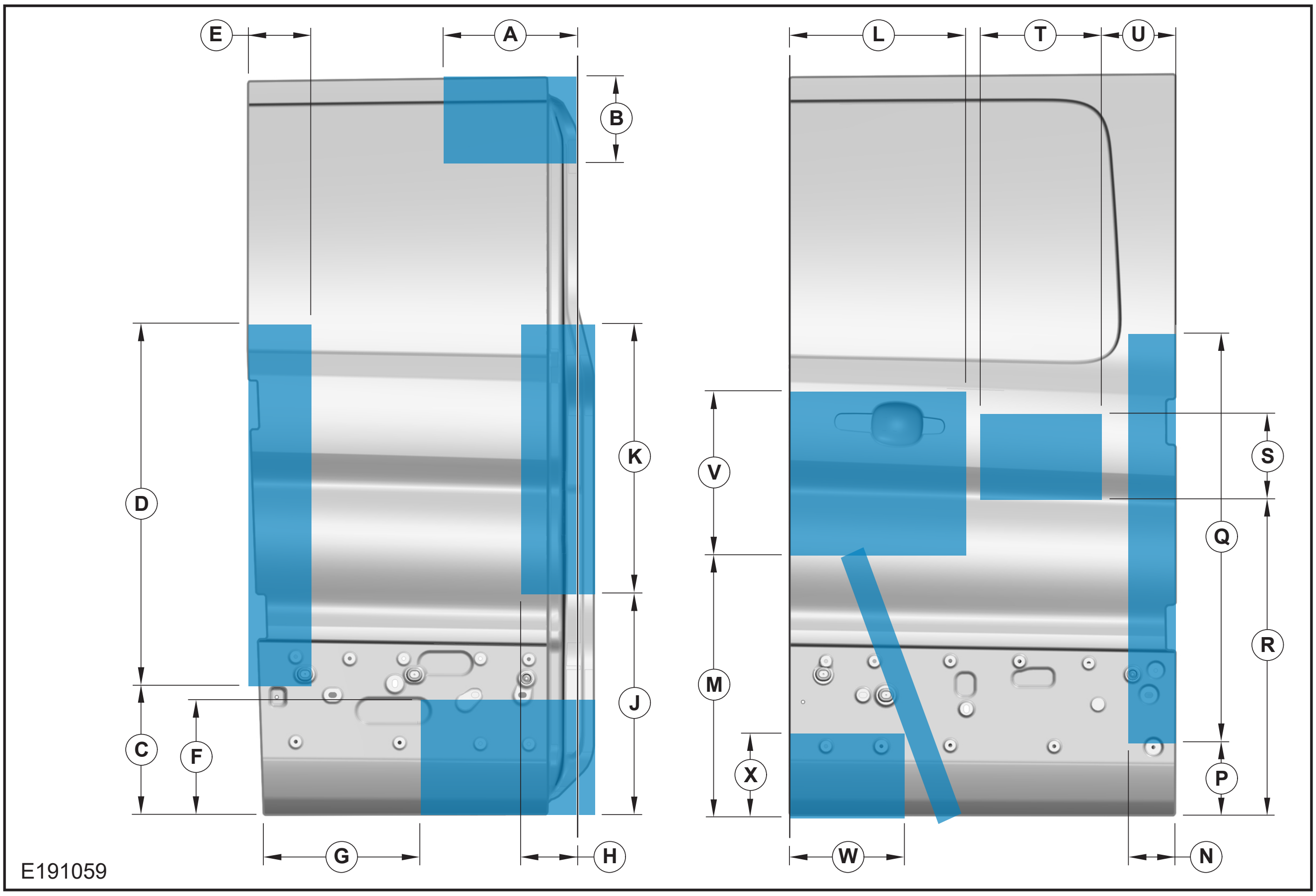


E188548

Item	Description
A	21.65” (550mm)
B	13.78” (350mm)
C	5.91” (150mm)
D	19.69” (500mm)
E	24.41” (620mm)
F	17.72” (450mm)

🟩 Abc = BEV Only 🟦 Abc = ICE Only

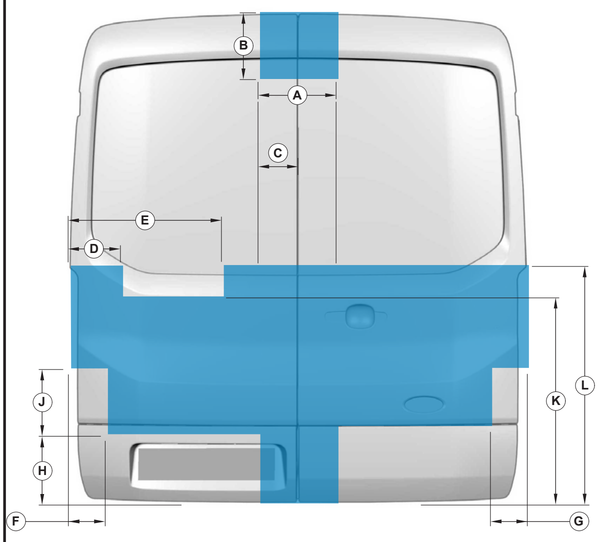
No Drill Zones - 60/40 Opening Side Cargo Doors



Item	Description
A	9.84" (250mm)
B	7.09" (180mm)
C	11.81" (300mm)
D	30.31" (770mm)
E	4.33" (110mm)
F	10.63" (270mm)
G	14.17" (360mm)
H	6.3" (160mm)
J	19.69" (500mm)
K	21.65" (550mm)
L	14.57" (370mm)
M	19.29" (490mm)
N	4.33" (110mm)
P	6.5" (165mm)
Q	34.25" (870mm)
R	28.35" (720mm)
S	3.94" (100mm)
T	7.09" (180mm)
U	7.09" (180mm)
V	17.91" (455mm)
W	9.45" (240mm)
X	5.91" (150mm)

🟩 Abc = BEV Only 🟦 Abc = ICE Only

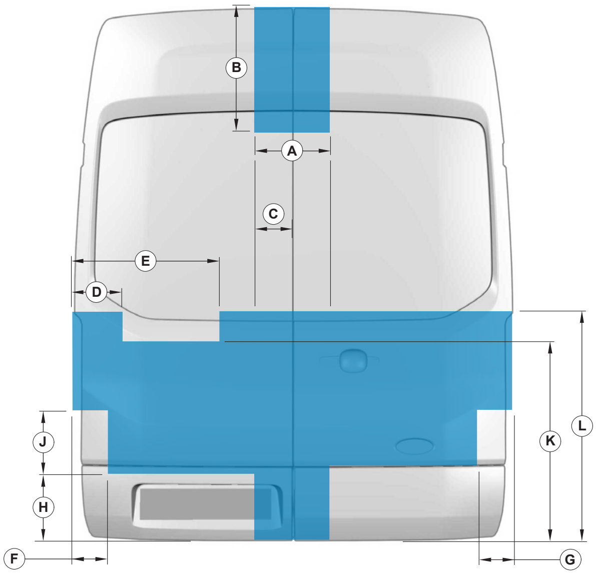
No Drill Zone - Rear Cargo Doors, Low and Medium Roof



E188549

Item	Description
A	13.39” (340mm)
B	12.6” (320mm)
C	6.69” (170mm)
D	9.84” (250mm)
E	23.62” (600mm)
F	7.87” (200mm)
G	7.87” (200mm)
H	11.81” (300mm)
J	11.81” (300mm)
K	31.5” (800mm)
L	36.22” (920mm)

No Drill Zone - Rear Cargo Doors, High Roof



E188550

Item	Description
A	13.39” (340mm)
B	21.7” (550mm)
C	6.69” (170mm)
D	21.7” (550mm)
E	13.39” (340mm)
F	7.87” (200mm)
G	7.87” (200mm)
H	11.81” (300mm)
J	11.81” (300mm)
K	31.5” (800mm)
L	36.22” (920mm)

5.7 Interior Trim

5.7.1 Load Compartment Interior Lining

Do not damage the lock, hinge, latch or check arm system (electrical cables, release system) when applying interior lining.

Be careful not to damage the weather shield (water shield covering inner door access hole) when removing or applying interior door trim.

WARNINGS:

⚠ **Plan fixing points for other fitments such as racking, to ensure through bolting can be achieved. Fixing to the lining material may be inadequate for normal safe operation of the vehicle.**

⚠ **Varnish or paint wooden interior cargo area panels if exposed to high humidity conditions.**

The additional weight of the linings on doors may require additional reinforcements to the door and pillar at the hinge and check mechanism.

5.7.2 Plywood Lining/Cladding

CAUTION: Do not drill into the vehicle before checking 'No Drill Zones' and electrical wire routing.

Refer to: 4.2 Wiring Installation and Routing Guides
Refer to: 5.6 Body Closures
Refer to: 5.1 Body

- Panels should be precision cut by machine, not by hand jigsaw, to reduce rough edges and splinters
- Panels should be pre-drilled
- Do not drill through floor panels, use existing load lashing points when securing the panels
- It is recommended that when fitting a plywood floor that it is joint free
- Use aluminium floor trims
- Plywood should be water resistant (WBP, water and boil proof)
- It is recommended to use 3/8" (9mm) thickness for floors and 1/4" (6mm) thickness for side and door lining

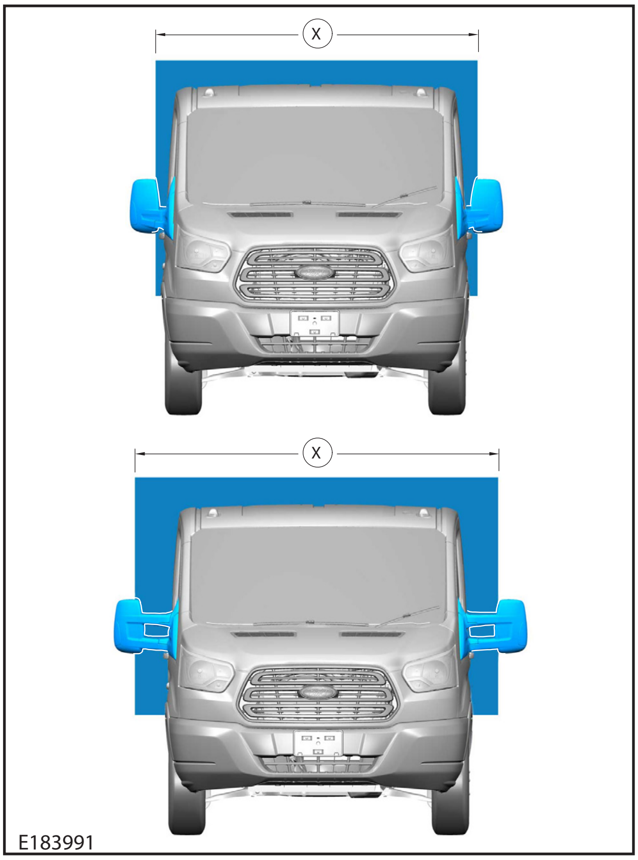
5.8 Door Mirrors

Short Arm Mirrors allow vehicle or trailer maximum widths of up to 86” (2184mm).

Long Arm Mirrors allow vehicle or trailer maximum widths of up to 96” (2438mm).

For availability of short and long arm mirrors or the less mirrors option, please contact your local Ford dealer.

NOTE: Vehicle modifiers must ensure that second unit body modifications comply with F/CMVSS requirements as specified in the IVM Manual.



5.9 Seats

NOTE: Care should be taken to properly wrap restraints to avoid contaminants during any modifications.

NOTE: When reassembling the seat and the seat belt use specified bolts and ensure to apply the specified torque. For torque specifications consult the workshop manual.

NOTE: Ensure that all electrical connections between the airbag and seat are reassembled where present.

NOTE: Cycle seat belt (by pulling seat belt out) after assembly to ensure proper functionality.

NOTE: On eTransit BEV,If the passenger seat is not fitted (passenger seat delete option) or removed, the standard charger unit cord storage location is lost and the convertor must provide an alternative storage feature for the cord.

Refer to:
5.11 Airbag Supplemental Restraint System (SRS)
5.12 Seatbelt Systems

5.10 Glass, Frames and Mechanisms

5.10.1 Heated Rear Window

⚠ **WARNING: The base system should not be tampered with (controlled by body control module and multiplex architecture) and no feeds taken from the associated wiring or controller.**

5.11 Airbag Supplemental Restraint System (SRS)

5.11.1 Airbags

Front Airbag Deployment Zones

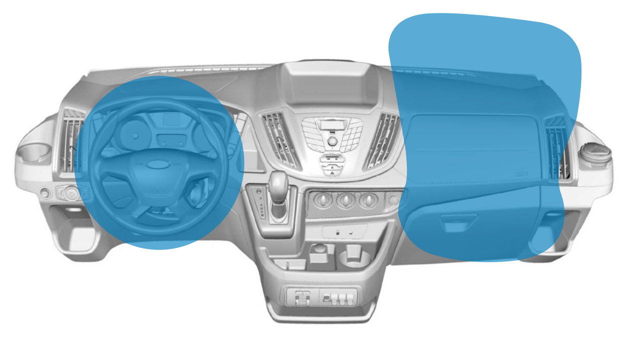
WARNINGS:

⚠ **Do not place accessories in the deployment zone of the driver and passenger airbags as they may impair airbag deployment.**

⚠ **Do not place stickers or decals over the airbag covers as this may impair airbag deployment.**

NOTE: Vehicles are fitted with a front passenger airbag as standard unless the front passenger seat is deleted. For vehicles with only a single row of seats, a passenger airbag deactivation switch is fitted in the glovebox. DO NOT remove or obscure the deactivation switch as this could restrict access or impair the function of the switch.

Front Airbag Deployment Zone



E193245

Side and Curtain Airbag Deployment Zones

WARNINGS:

⚠ **Do not place accessories in the deployment zone of the side and curtain airbags as they may impair airbag deployment.**

⚠ **Do not place stickers or decals over the airbag covers as this may impair airbag deployment.**

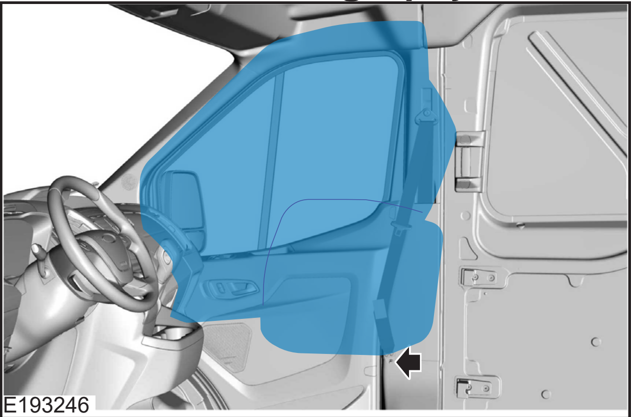
NOTE: All Vans get standard side seat/side curtain airbags. It is recommended to specify a base vehicle without airbags if planning modifications in this area.

Side Airbags (Seat Mounted): The side airbags on this vehicle have not been validated for use with swiveling front seats. Do not specify a base vehicle with side airbags if planning to retrofit a swiveling device on the front seats and/or an armrest on the outer side of the front seats; this may affect the function and/or deployment of the side airbags. Ensure any seat covers installed are designed to be used with side airbag equipped seats.

Curtain Airbags: Extensive modifications to the roof and headlining may impair deployment of the curtain airbags. If roof or headlining is to be modified or replaced, do not specify curtain airbags on the base vehicle.

If access to the roof is required, to install roof mounted exterior accessories for example, ensure the unmodified headlining is refitted using the existing mounting points.

Front Side Curtain Airbag Deployment Zone

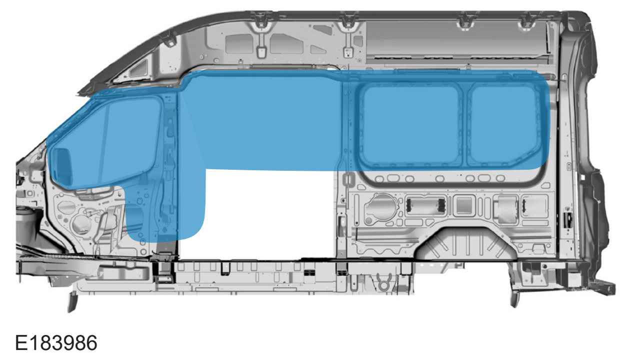


E193246

⚠ **WARNING: Do not drill in Right Hand/Left Hand side retractor assy area.**

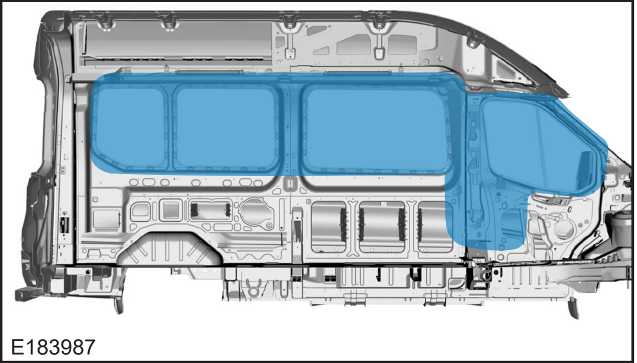
For additional information on Precautionary Drill Zones Refer to: 5.6 Body Closures

Curtain Airbag Deployment Zone - Wagon only (RHS)



E183986

Curtain Airbag Deployment Zone - Wagon only (LHS)



E183987

Restraints Control Module (RCM)

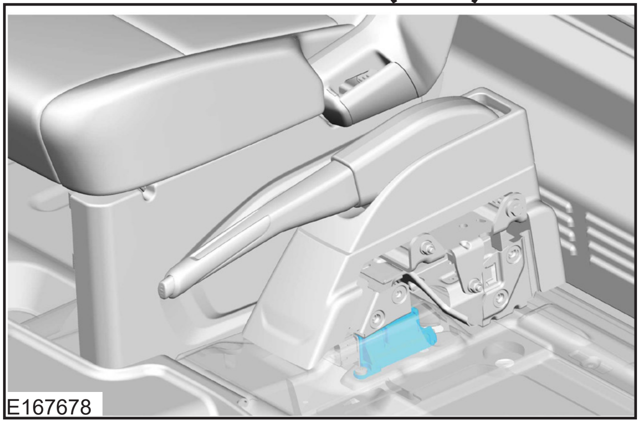
The RCM is located between the front seats, underneath the parking brake console, see figure E167168.

WARNINGS:

Conversions or reinforcements in the area of the RCM may affect the side airbag deployment timing and result in uncontrolled side airbag deployment.

The RCM device is protected by the parking brake and console, to prevent damage from occupants when stepping past the seat to access the rear of the vehicle. The parking brake and console should be maintained in their fitted position to ensure protection for the RCM.

Restraints Control Module (RCM)



Front, Side and Sensors

The airbag sensor for the front airbags is located behind the front grille, see figure E167679.

The sensors for the side airbags are located at the bottom of the B-pillars, see figure E145412, and in the front door, see figure E167680.

Additional side airbag sensors are located under the windows on wagon variants, see figures E183988 and E183989.

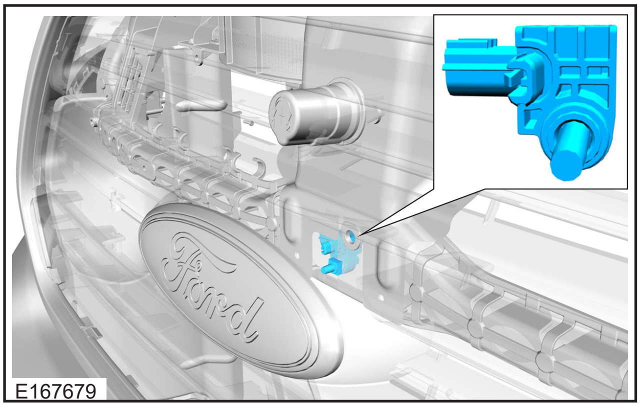
WARNINGS:

Modifications or reinforcements in the area of the sensors may affect the side airbag deployment timing and result in uncontrolled side airbag deployment.

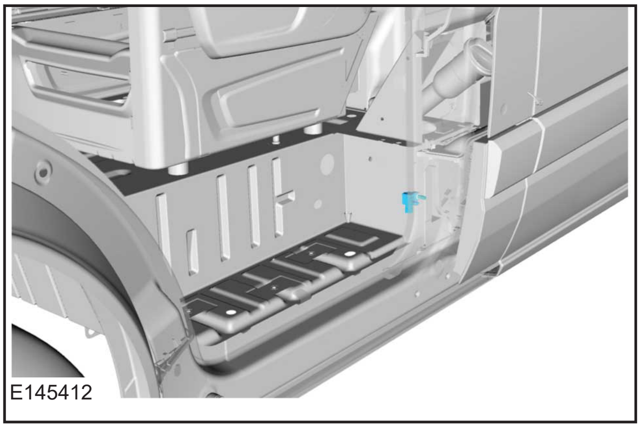
Drilling or grinding operations in these areas are only permitted when battery cables are disconnected.

If the battery is disconnected Refer to: 4.5 Battery and Cables Battery and Monitoring Sensor section for reconnecting battery.

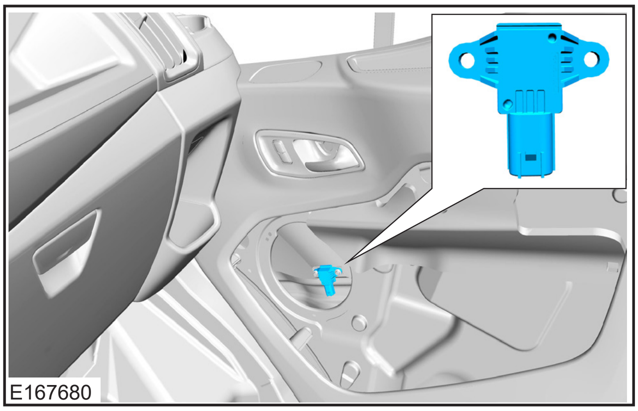
Front Sensor - All Variants



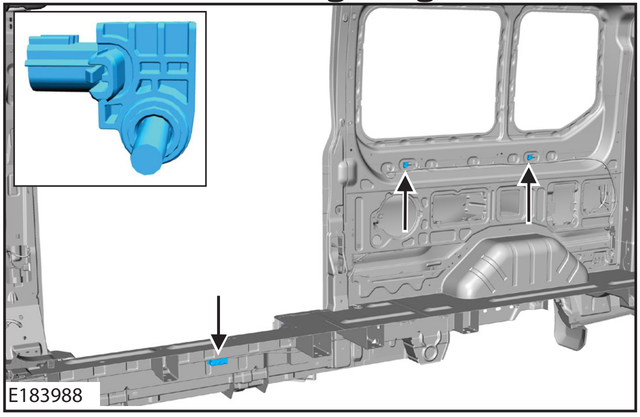
Front Side Sensor - All Variants



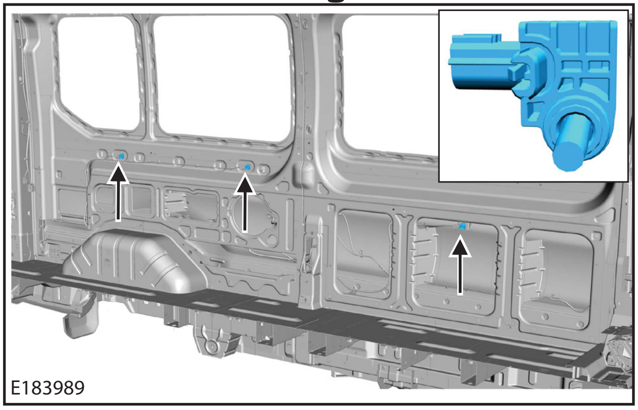
Door Sensor - All Variants



Rear Side Sensors - Wagon Right Hand Side



Rear Side Sensors - Wagon Left Hand Side



5.12 Seatbelt Systems

5.12.1 Seatbelts

WARNING: Follow removal and installation procedures for the seatbelt system to ensure correct function of the restraints system.

Seat Belt Buckles must not be modified in situ on the Seats. If Seat Belt Buckle requires modification or removal, then this must be performed by OEM Seat supplier.

The removal and re-installation of the seatbelt, buckle or any component of the seatbelt system should be avoided. However, if removal and re-installation of the system is required during the conversion, follow the removal and installation guidelines of the seatbelt system as described in the workshop manual.

When removing the seatbelt system, a seat belt webbing forked retainer should be applied to the webbing 200mm below the webbing button stop. This prevents a situation where all the webbing runs back into the retractor and the retractor becomes locked.

When re-installing, fit the retractor to the body first and gently pull the webbing out of the retractor to allow fitment of the D loop; then remove the forked retainer. If the retractor is locked, allow a small amount of webbing to reel back into the retractor to allow the webbing lock to release. Do not attempt to release the retractor by pulling on the webbing with significant force or by manually interfering with the locking mechanism.

5.12.2 B Pillar No Drill Zone

WARNINGS:

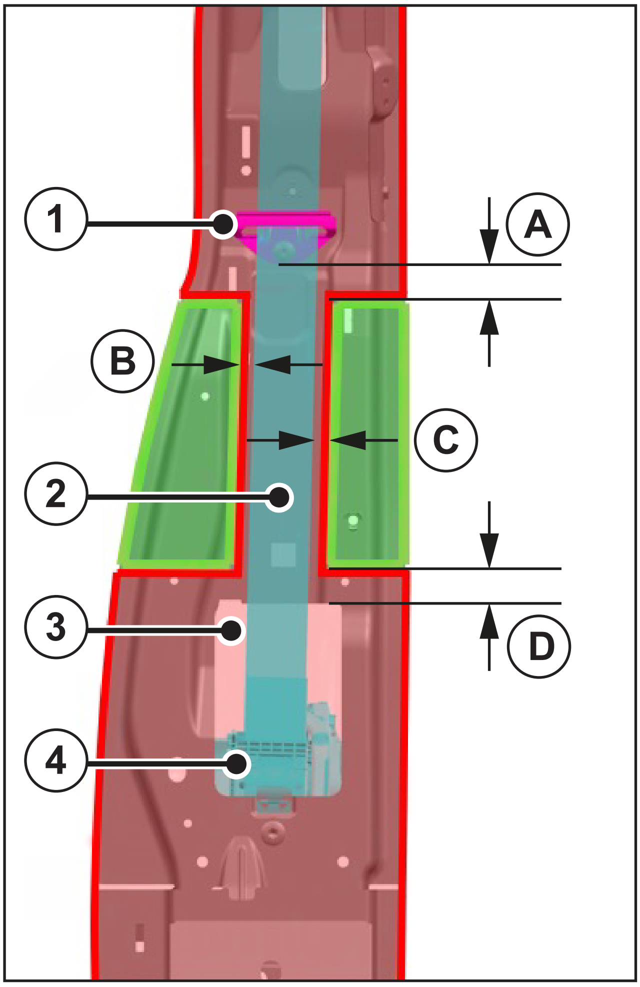
Do not drill in right hand/left hand side retractor assembly area.

Drilling is only permitted in the green area indicated.

Retractor damage: If drilling holes near or above the retractor and anchor pretensioner, the mechanisms must be covered to prevent swarf/debris from falling into the assembly and causing functional issues.

Webbing damage:
1) Any additional hardware fitted must not cut, pinch or interfere with the seatbelt webbing along its entire path (from retractor to D-ring area).
2) Avoid sharp brackets near webbing; all edges must have a minimum radius of 0.5mm.
3) Avoid upfitting parts that may change the belt routing to the occupant.

Front Seat Belt/B Pillar Drill Zone Definition



F50044

Item	Description
1	Webbing Guide
2	Seatbelt Webbing
3	Retractor Hole
4	Retractor
A	30mm Below Webbing Guide
B	15mm Left of Webbing
C	15mm Right of Webbing
D	30mm above Retractor Hole

5.12.3 Driver Belt-Minder

Driver belt-minder is a legal requirement. A switch is provided in the driver's buckle to sense the seatbelt wearing status of the driver. If a vehicle is modified, this function must be retained.

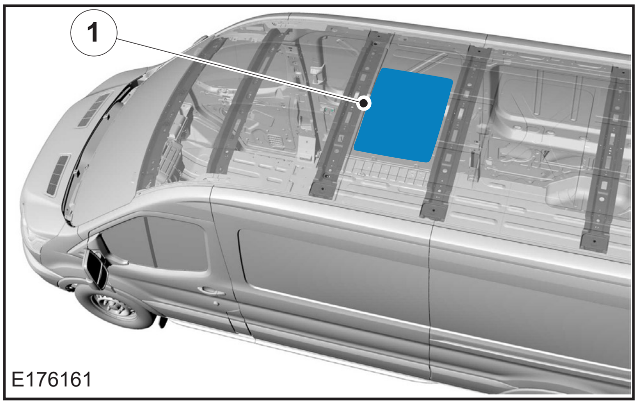
5.13 Roof

5.13.1 Roof Ventilation

General - Apertures must not cut through roof bows, see figure E176161. Ventilators must prevent direct entry of water and dust. A shut-off system should be available to prevent fume ingress. Interior and exterior projection legal requirements must be maintained.

In case a roof bow is cut or removed, it must be replaced by an appropriate structure providing the equivalent structural integrity and functionality as the original structure. Any legal requirements must be maintained.

Air Conditioning Units - Units weighing more than 55lb (25kg) must be internally supported on cross brace members distributing the load out to the roof rails.



E176161

Item	Description
1	Roof Panel Aperture

Ventilation Units - The roof panel can support up to 2.2lb (1kg) on an unsupported area of roof. Loads up to a maximum of 55lb (25kg) must be distributed over the full length of the roof rails between the roof bows.

5.13.2 Roof Racks and Load Carriers

Load Retaining Fixtures

WARNING: Refer to the Owner's Manual for information on Load Carrying and maximum roof loads.

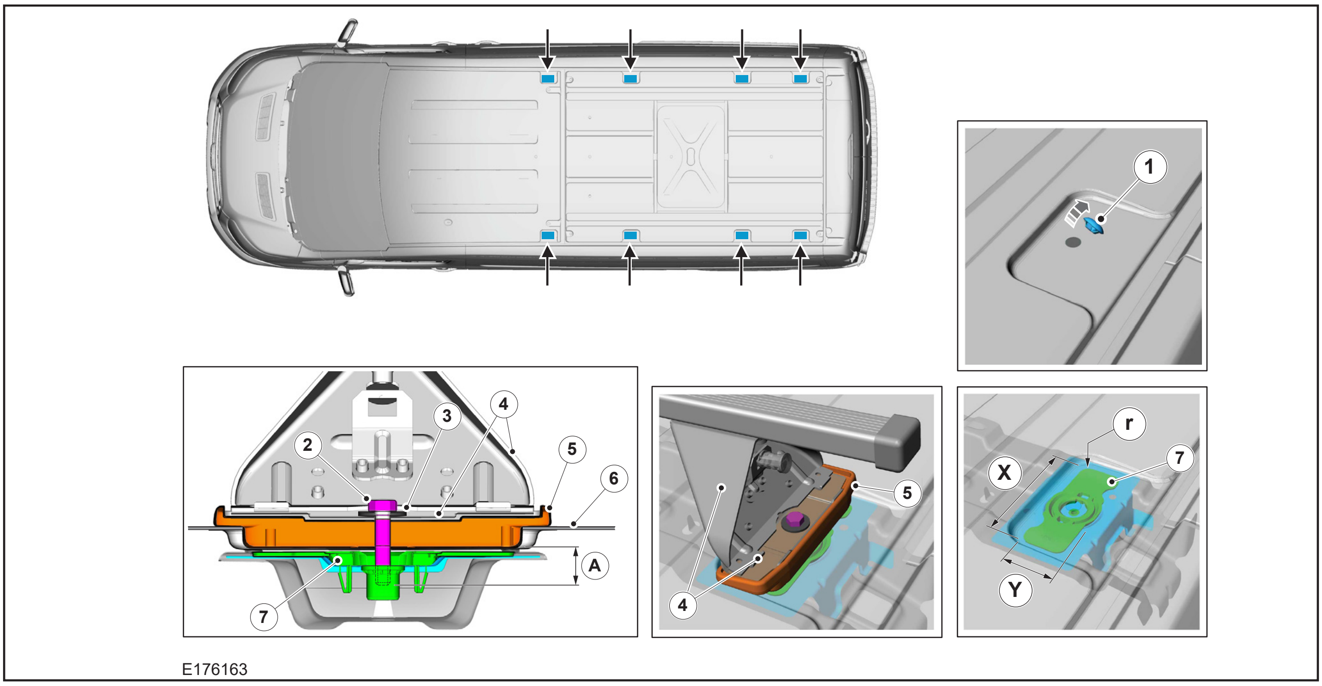
NOTE: Read and follow the manufacturer's instructions when fitting a roof rack.

NOTE: The number of load retaining fixtures vary depending on the vehicle.

Roof racks may be fitted to all Van, Bus and Kombi variants providing the following is satisfied:

- Load not to exceed 79.3kg at individual attachment points for local durability
- Refer to: 1.12 Load Distribution For guidance on center of gravity information
- Ideally, the bearing surface of the roof rack attached should be the same as the reinforcement inside the roof, see figure E176163, item 7 and dimensions X,Y and r
- Ensure sealing of surfaces, for example: with EPDM rubber material or equivalent and ensure sealing along the bolt for preventing water ingress into the interior of the vehicle, see figure E176163 items 3 and 5
- The thread size is M8. The maximum intrusion of the M8 bolt into the roof is 16mm, see 'A' in figure E176163.
- Read and follow the manufacturer's instructions when fitting a roof rack
- When removing the roof rack ensure holes are properly sealed with sealing plugs or equivalent water tight elements

Recommended Design Principles - Load Retaining Fixtures

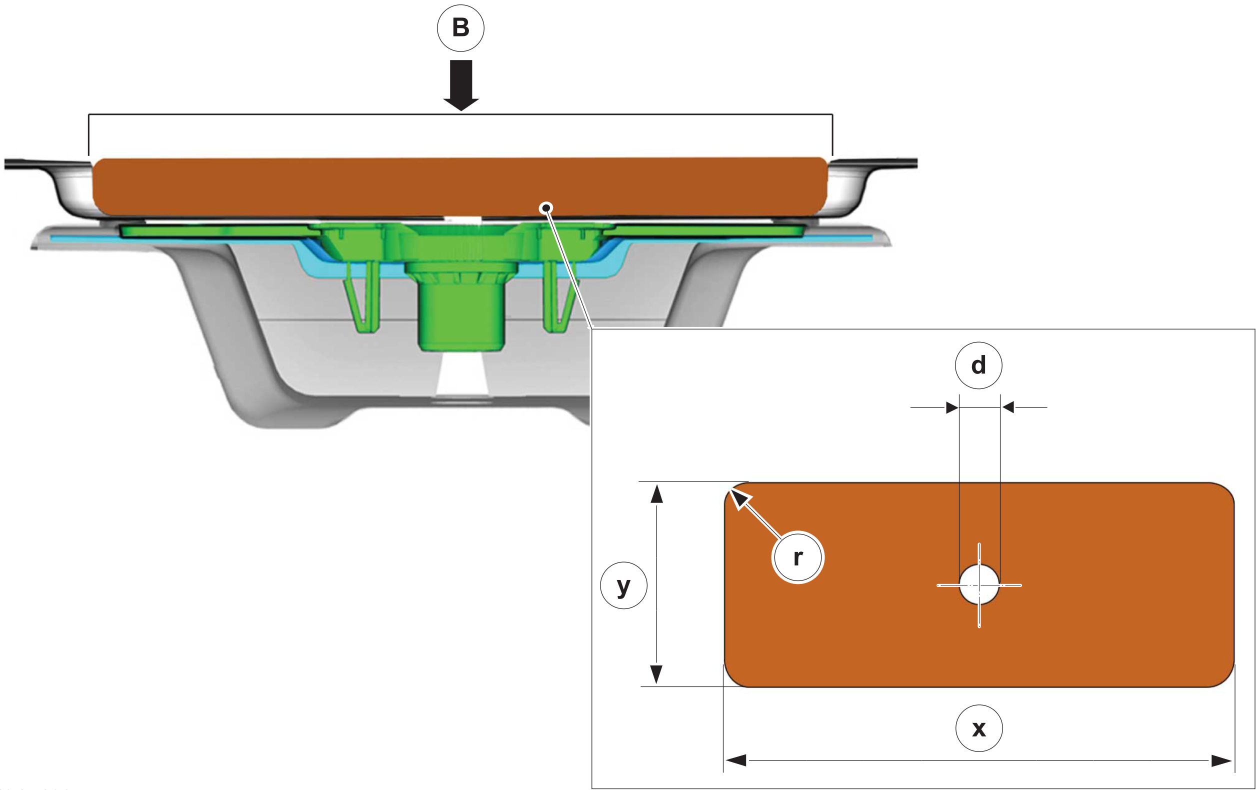


E176163

Item	Description
1	Plug to avoid water ingress and corrosion
2	M8 Bolt
3	Seal
4	Roof Rack System
5	Seal/Spacer (see E247462)
6	Roof Panel
7	Reinforcement
A	Maximum intrusion 0.62” (16mm)
X	5.1” (130mm)
Y	1.85” (47mm)
r	0.4” (10mm)

Item	Description
B	Load Bearing Surface – Lateral roof rack beams should be centered fore/aft over the roof mounting points/depressions
X	5" (127mm)
Y	2” (50.8mm)
r	0.25” (6.35mm) radius x4
d	0.394” ±0.0059” (10.00 ±0.15 mm) diameter hole (center of spacer)

Recommended Spacer Dimensions



E247462

NOTE: De-burr all edges.

NOTE: Avoid load application to Class A roof panel surface.

Trimline Tolerance ±/0.0197” (0.5mm)
Material Thickness Low Roof = 0.375” (9.523mm).
Material Thickness Medium and High Roof = 0.56” (14.28mm).

5.14 Corrosion Prevention

5.14.1 General

Extreme heat, such as paint drying ovens, will cause the damage of the High Voltage battery. The High Voltage battery must be removed before using paint drying ovens longer than 45 minutes or with temperatures above 60°C (140°F). Failure to follow this instruction may result in damaging the High Voltage battery, which could cause serious personal injury or death in a fire or explosion.

Do not apply any coating/corrosion prevention treatment to the HV battery pack area and connectors.

Avoid drilling into closed frame body members to avoid the risk of corrosion from waste metal filings.

If drilling is required, however:

- Re-paint metal edges and protect against corrosion after cutting or drilling operations
- Endeavor to remove all waste metal filings from inside the side member and treat to prevent corrosion
- Apply corrosion protection inside and outside of the chassis frame

For Welding:
Refer to: 5.1 Body

5.14.2 Repairing Damaged Paint

After cutting or reworking any sheet metal on the vehicle, the damaged paint must be repaired.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance where possible.

5.14.3 Under Body Protection and Material

WARNING: Do not over-coat or contaminate surfaces of components such as brakes or catalytic converters.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance where possible.

Some proprietary products affect the original coatings.

5.14.4 Painting Road Wheels

WARNING: Do not paint wheel clamp surfaces in contact with other wheels, brake drum or disc, hub and holes or surface under wheel nuts. Any further treatment in these areas may affect the wheel clamp performance and the vehicle safety. Mask the wheel when changing the color or repairing paint.

5.14.5 Contact Corrosion

When using different materials with a different electrochemical potential, ensure that materials are isolated from each other to prevent contact corrosion caused by a potential difference.

Use appropriate isolation materials. Where possible, choose materials with low level of electrochemical potential difference.

5.15 Frame and Body Mounting

5.15.1 Mounting Points and Tubing

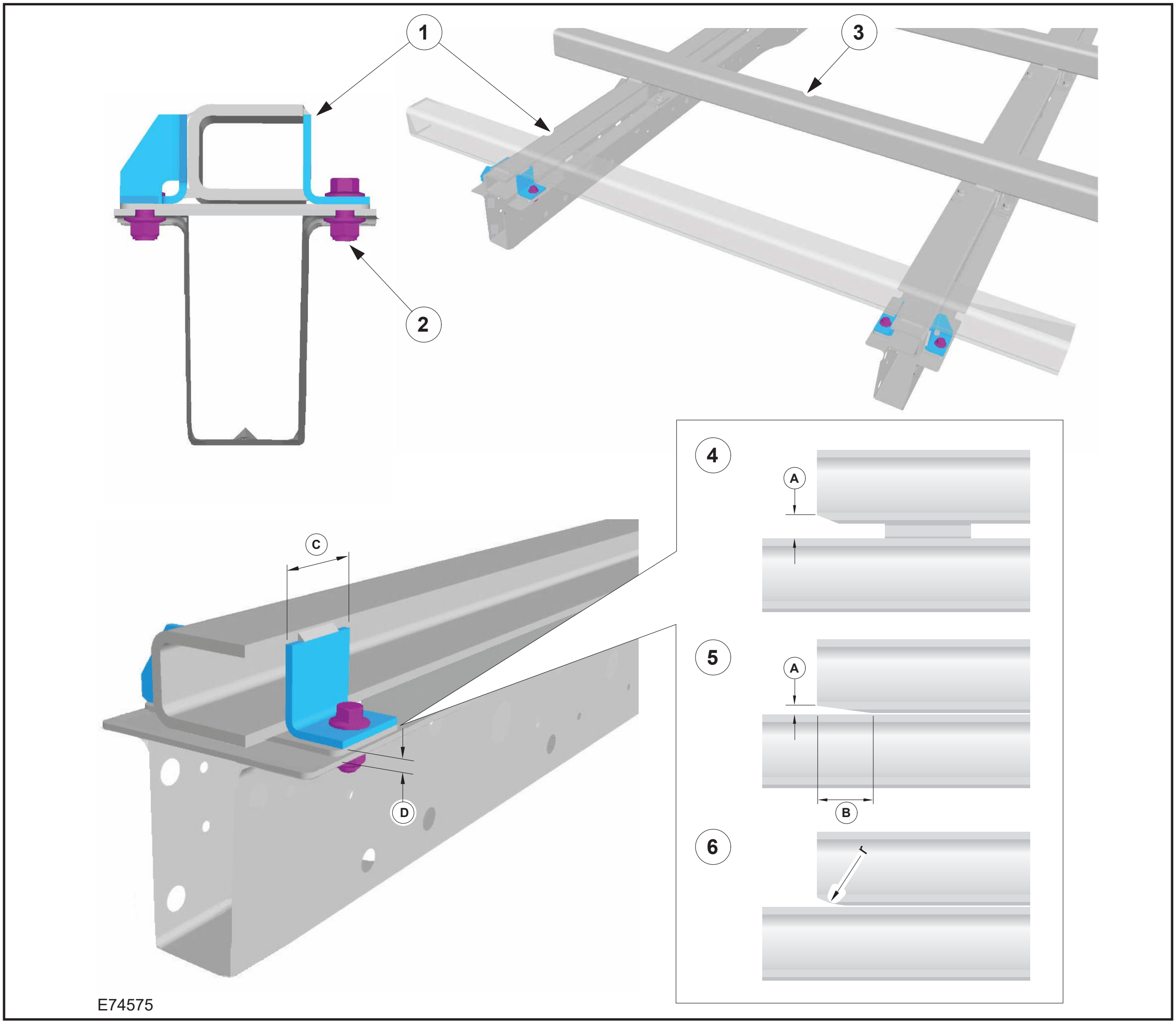
The holes on the frame are a result of the production process. They are not designed for fixing additional equipment. Tube reinforcements are required to avoid crushing of the box frame construction. If additional fixings to the chassis frame are required please follow the recommendation given in figure E192371. This does not apply to areas of load applications such as spring fixings or damper fixings.

Vehicle modifiers are responsible for added weight and design prove out.

NOTE: After drilling, deburr and countersink all holes and remove chips from the frame. Follow corrosion prevention.

Refer to: 5.14 Corrosion Prevention

Subframe for Low Floor or other Equipment - Chassis Cab and Cutaway (Examples)



Item	Description
1	Continuous longitudinal float or body support member
2	Always use both sides of all chassis mounts
3	Crossmembers
4, 5, 6	Relief front end and longitudinal if there is a risk of stress concentration in chassis frame from longitudinal contact
A	0.2” (5mm) minimum
B	1.97” (50mm) minimum
C	1.97” (50mm) width for all brackets
D	Avoid longitudinal contact if possible which may create stress concentration
r	0.79” (20mm) minimum

5.15.2 Self-Supporting Body Structure

Bodies and structures can be judged as self-supporting providing they maintain the following rules:

- Cross members are used at each chassis mounting point, please refer to: 5.1 Body - Chassis Frame Body Attachment: figures E184867, E184868 and E184869, also E74576 and E189873 in this section
- Each crossmember has a suitably engineered connection to the body sidewall (3) or to the continuous floor frame (5), shown in figure E74576
- The body sidewall or the continuous floor frame supports any overhang beyond the chassis frame, whether on standard frame or extended frame

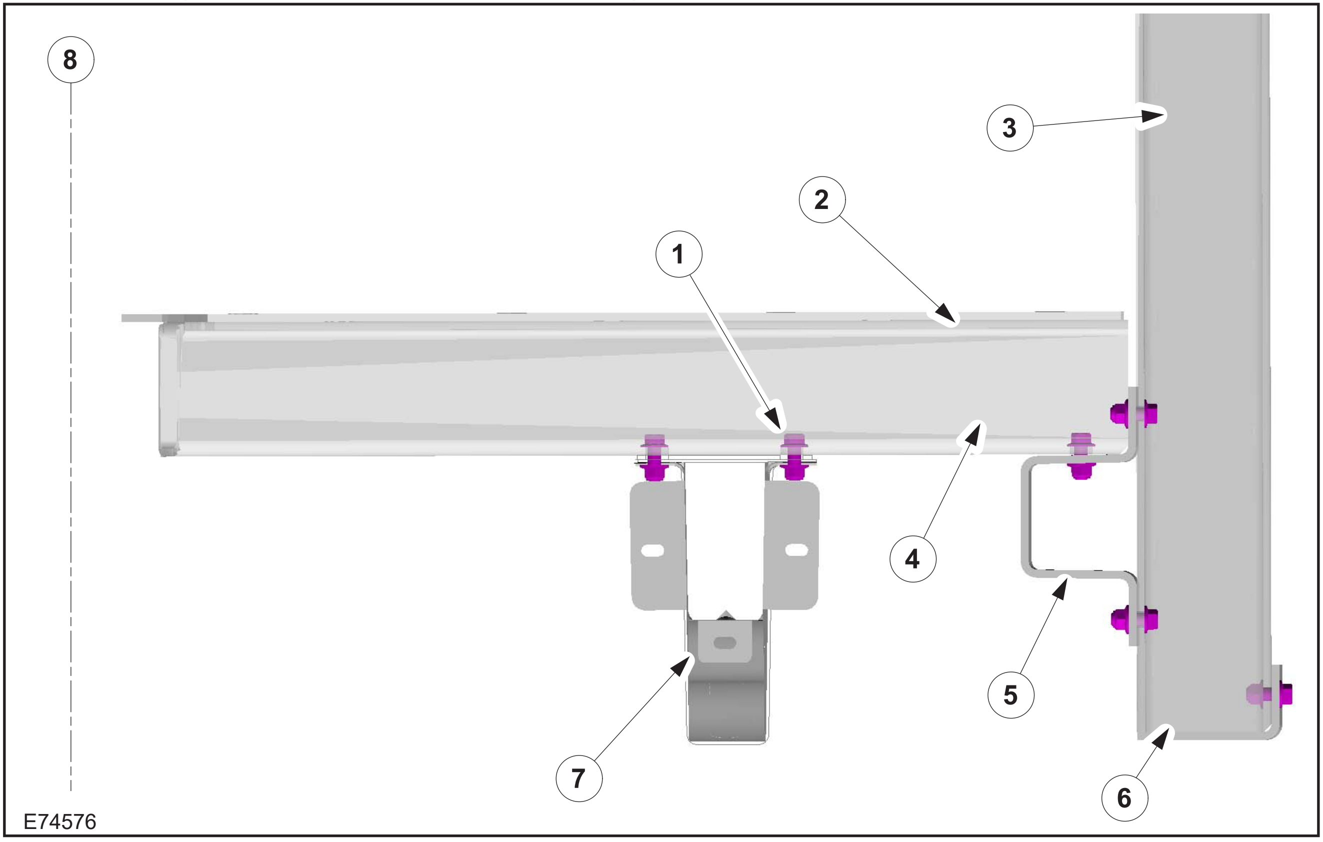
Alternatively, the self-supporting body structure can also be designed as shown in figure E74577. This concept is based on a self-supporting structure where the floor is mounted directly onto the top surface of the chassis frame.
Figure E74577 shows a generic vehicle cross section where the cross members and opposing outriggers are flush with the surface of the chassis frame side members.

It is important to the overall function of the vehicle structure that the outriggers are each connected to a continuous longitudinal floor side frame or a structural body side structure assembly.

Low floor re-work for guidance only:

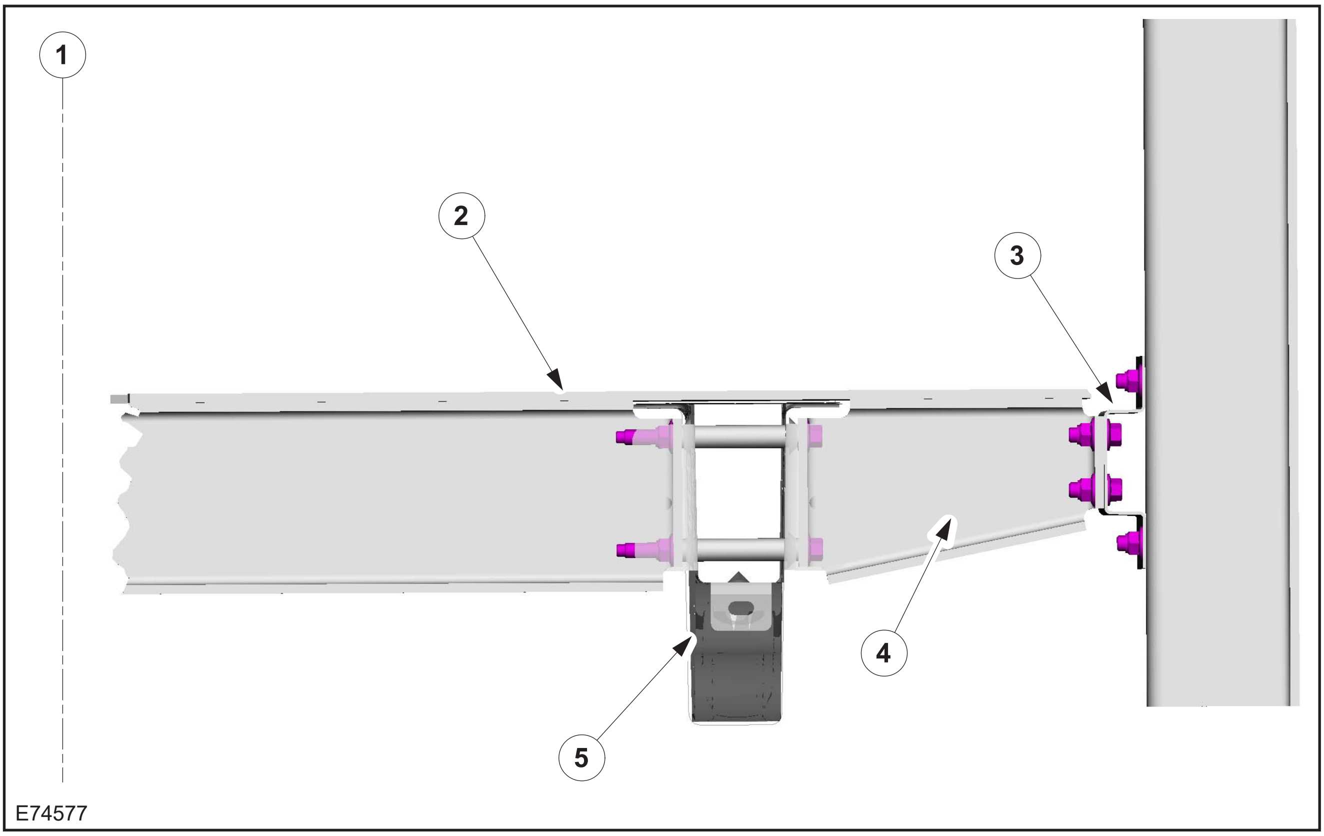
- Engineer unique crossmembers and outriggers spaced at approximately 24” (600mm) maximum pitch
- Outrigger moment to be re-acted with crossmember between chassis frame, with common through bolts where possible; see figure E74577 Low floor standard chassis frame
- Drill frame and add spacer tubes, see frame drilling & tube reinforcing; see figure E192371
- Outrigger outboard ends should be attached to load bearing body side/floor edge frame or body side structure (including over wheel support)

Typical Design Principle of a Self-Supporting Body Structure



Item	Description
1	Use all standard locations with 2x M10 fixings
2	Floor Panel
3	Body side frames
4	Floor crossmembers
5	Continuous floor U-profile frame
6	Longitudinal L-profile
7	Chassis frame rail of base vehicle
8	Vehicle center line of base vehicle

Low Floor Standard Chassis Frame



E74577

Item	Description
1	Vertical center line of vehicle
2	Floor panel
3	Continuous floor edge longitudinal
4	Outrigger
5	Low floor

- Structural wheel box should maintain longitudinal continuity with a rigid attachment to the floor edge frame or to the body side structure
- Floor boards should be substantially attached to cross members and outriggers, but not to the chassis frame top surface
- Low floor exhaust heat shields;

Refer to: 3.5 Exhaust System

5.15.3 Extended Chassis Frame

General:

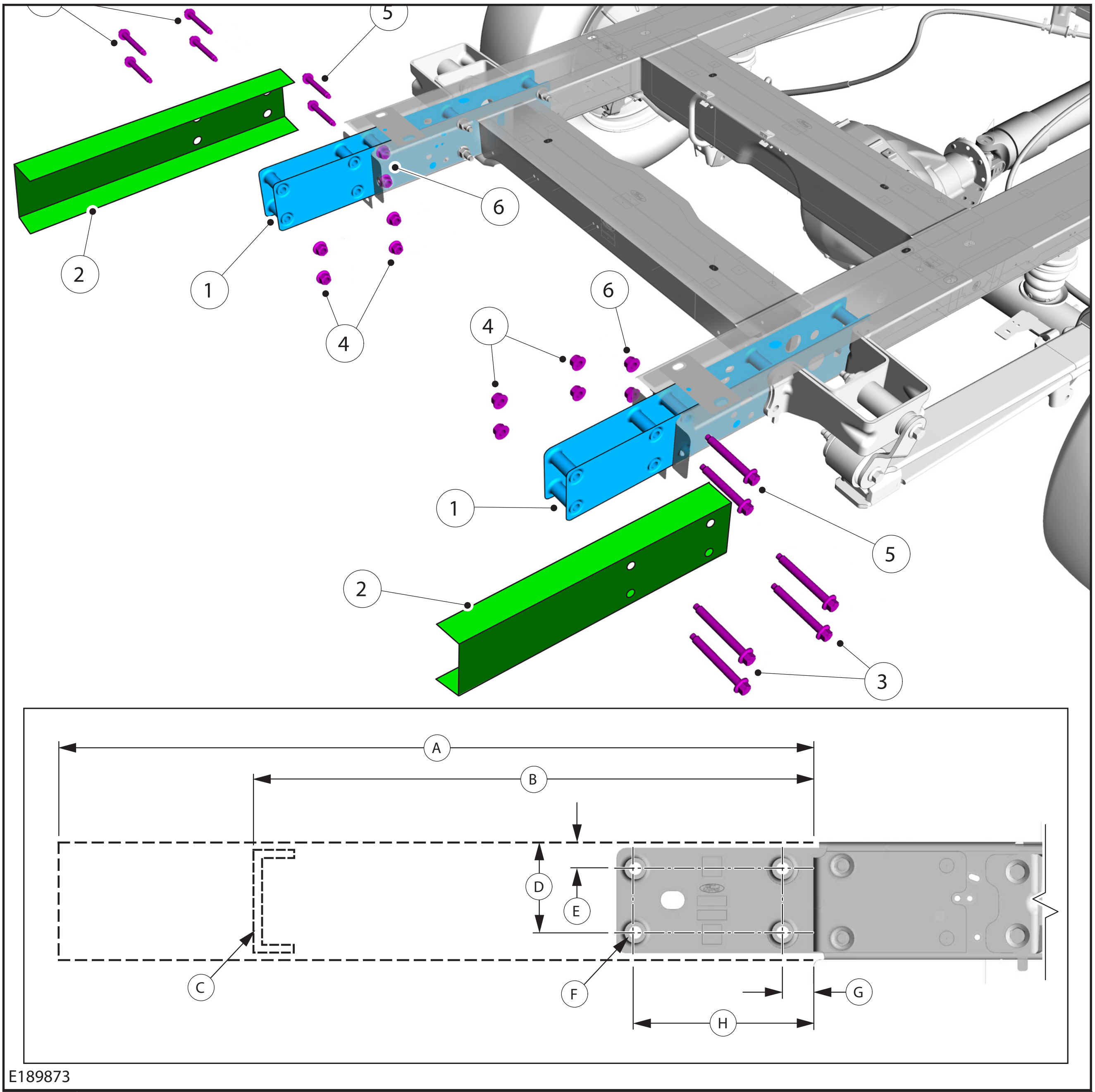
- Frame Extension Adaptors are supplied with vehicles
- Bodies or equipment exceeding the standard extension length must be supported, please refer to figure E74575 low body longitudinal members or figure E74576 self-supporting body structures
- It is the Vehicle Convertor's responsibility to mark up the Owner's Manual advising the available payload. Axle plated weights and maximum allowable axle mass, as shown in this manual, must not be exceeded
- The vehicle should be planned for uniformly distributed loads

Extensions must comply with the following guidelines:

- Flat-beds and low bodies built onto Non Regular Production Option extensions must have continuous longitudinal members engineered by the Vehicle Modifier or equipment supplier, please refer to figure. E74575, to resolve the worst case moments at rear bump stop
- Extensions should be secured to the Frame Adaptor utilizing the 4 bolts and 4 holes in the rear of the Frame Adaptor, total 8 per vehicle, see figure E189873 items 3 and 4
- The Frame Adaptor should be secured to the frame utilizing the 2 bolts and 2 holes in the rear of the frame, total 4 per vehicle, see figure E189873 items 5 and 6
- Drilling of the top flanges turned out is only permissible rearward of the spring hanger brackets, for continuity of the altered extension closing plate, if required. The diameter of the holes should be 0.24" (6mm) maximum
- It is recommended that the altered extension has similar properties to the existing chassis frame
- An equivalent open section for the extension assembly is at the Vehicle Modifier's discretion
- Lightening holes in new extension and crossmembers are discretional

Non Standard Rear Chassis Frame Extension

Non Standard Rear Chassis Frame Extension



E189873

Item	Description
1	Rear Frame Extension Adaptor (supplied with vehicles)
2	‘C’ Channel Frame Extension (Supplied, if required, by Vehicle Modifier)
3	4 x Bolts (each side) M12 -1.75 Grade 10.9 - Torque 66.4 -76 ft-lb (90-103Nm)
4	4 x Nuts (each side) M12 - 1.75 Grade 10.9
5	2 x Bolts (each side to be retrofitted by the vehicle modifer) M12 -1.75 Grade 10.9 - Torque 66.4 -76 ft-lb (90-103Nm)
6	2 x Nuts (each side to be retrofitted by the vehicle modifer) M12 - 1.75 Grade 10.9
A	Maximum Frame Extension Length - 138”(3505mm) RWB 30” (762mm), 156” (3962mm) LWB 50” (1270mm), 178” (4521mm) ELWB 80”
B	To be determined by the Vehicle Modifier
C	Greater than 60” (1524mm) extension requires additional crossmember
D	3.72” (94.4mm)
E	1.16” (29.4mm)
F	4 holes (each Side) 0.5” (12.8mm)
G	1.23” (31.3mm)
H	7.14” (181.3mm)

- Do not weld original chassis frame, except as specified when adding reinforcing tubes
- Do not drill the top or bottom surface of the chassis frame, including the flanges turned out, except as recommended above for continuity of closure
- Any alternative finish, such as hot dip galvanizing, is at the discretion of the Vehicle Modifier, providing it does not have a detrimental effect on the original Ford product.

Refer to: 5.14 Corrosion Prevention

5.15.4 Frame Drilling and Tube Reinforcing

The chassis frame may be drilled and reinforcing spacer tubes may be welded in place, providing the following is applied:

- Locate and drill holes accurately, using a drill guide to ensure holes are square to frame vertical center line (allow for side member draft angle)
- Drill undersize and ream out to size
- Endeavor to remove all waste metal filings from inside side member and treat to prevent corrosion
- Fully weld each end of the tube and grind flat and square, in groups if applicable. Be aware of side member draft angle
- Apply corrosion protection inside and outside of the chassis frame.

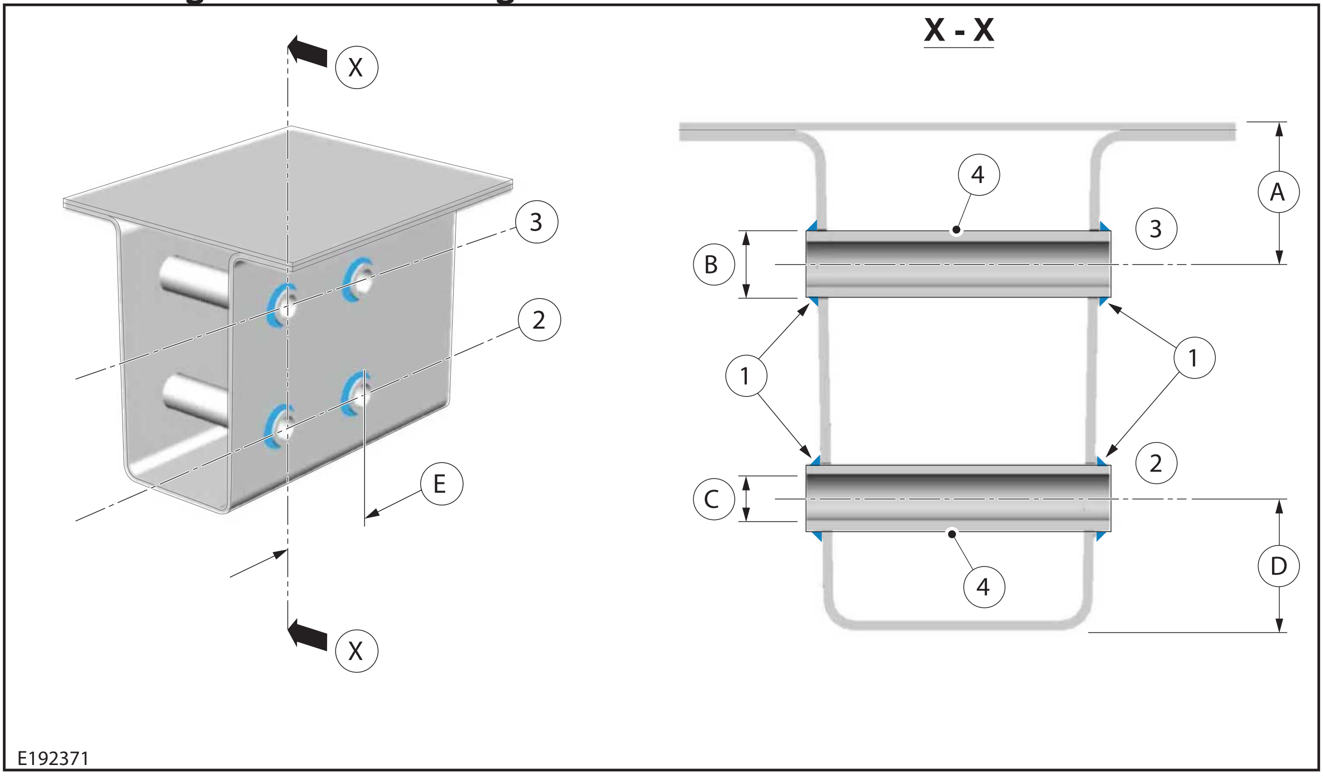
Refer to: 5.14 Corrosion Prevention

- Holes should be in groups of two, either vertically spaced at 1.18” to 1.38” (30mm to 35mm) from chassis frame top and/or bottom surface, or horizontally at 2” (50mm) minimum pitch, 1.18” to 1.38” (30mm to 35mm) from top and/or bottom chassis frame surface
- Always use M10 bolts with grade 8.8 minimum
- Do not position tubes at the medium chassis frame height, this may create ‘oil canning’ of the deep section sidewalls
- Where possible, the outrigger moments should be resolved by matching inner crossmembers between the chassis side members inline with the outriggers, please refer to figure E74577
- A diameter of 0.65” (16.5mm) is the maximum allowable hole size in the chassis frame sidewall, irrespective of the usage

Avoid drilling into closed frame body members to avoid the risk of corrosion from waste metal filings.

Refer to: 5.14 Corrosion Prevention

Frame Drilling and Tube Reinforcing



Item	Description	Item	Description
1	Full Penetration; Full diameter weld each side	B	Diameter 0.65” (16.5mm) maximum
2	Center line of holes/tubing	C	Diameter 0.43” (11mm)
3	Center line of holes/tubing	D	1.18” to 1.37” (30mm to 35mm)
A	1.18” to 1.37” (30mm to 35mm)	E	1.97” (50mm) minimum

It is recommended to always use a tube.

It is recommended to always use washers. Size minimum equal to lower rail width.

Drilling and welding of frames and body structure have to be conducted following the guidelines. Refer to: 5.1 Body Welding.

5.15.5 Ancillary Equipment - Subframe Mounting

Typical subframes and longitudinal members for flatbed and low or dropside bodies, or equipment exceeding the standard or Regular Production Order frame length, should adhere to the following guidelines (not for Motorhomes):

- Flat-beds and low bodies mounted on integral longitudinal members, channel or box section metal – not wood - must use both sides of all frame mounting brackets, see figure E74575
- Longitudinal members must be relieved at the front end if they are to contact the chassis frame top surface, to minimize stress concentrations; see figure E74575. However, it is preferable to mount the longitudinal onto the mounting brackets, with a clearance to the chassis frame top surface
- Each set of brackets must use 2 x M10 bolts grade 8.8 minimum
- The rear 2 sets of chassis frame mounting holes/locations should have a full bolt torque with 100% grip. The attachment to the remaining forward chassis frame holes/locations must be precisely located and retained, but allow some relative flexing between the subframe and chassis frame. For example, clamp control devices such as conical washer stacks or machine springs with self-locking fasteners
- Minimum floor heights will require wheel arch boxes to clear the rear tires, see Vehicle Data sheets for relevant tire jounce

Pedestal mounted low or drop side bodies – (not illustrated).

For bodies or equipment not exceeding the standard or Regular Production Order chassis frame length.

For flat beds and low bodies raised above the maximum ‘jounced’ tire position to obtain an uninterrupted flat floor surface see vehicle data sheets.

- Fore and aft longitudinal bracing must be added between the rearmost 2 cross members only
- All chassis frame mounting holes/locations must always be used
- All chassis frame mounting bracket fastenings must have a full bolt torque with 100% friction grip

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